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, 209, lines 11–12, for *Lagenospora* ,, *Lagenophora.*
,, 343, line 17, for marginalis ,, marginale.
,, 345, ,, 15, ,, Weis., ,, Weis,
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,, 360, ,, 29, ,, BRAINIOIDES ,, BRAINEOIDES.
,, 360, ,, 29, ,, *brainioides* ,, *braineoides.*
,, 362, ,, 1, ,, ENEAPHYLLA ,, ENNEAPHYLLA.
,, 378, ,, 2, ,, CUCULATUM ,, CUCULLATUM.
,, 381, ,, 4 from bottom, for palmatopedatum, *Christ*, read palmatopedatum, *Baker*.
,, 386, ,, 14, for FRANCHETTI read FRANCHETII.
,, 392, ,, 23, ,, CARCINA ,, CARICINA.
,, 395, ,, 27, ,, *Trachytillæ* ,, *Trachytellæ.*
,, 439, ,, 12, ,, BONDIERI ,, BOUDIERI.
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THE JOURNAL

OF

THE LINNEAN SOCIETY.

(BOTANY.)

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The Algæ of the Yan Yean Reservoir, Victoria: a Biological and Œcological Study.

By G. S. West, M.A., D.Sc., F.L.S., Lecturer on Botany in the University of Birmingham.

(Plates **1–6** and 10 Text-figures.)

[Read 18th June, 1908.]

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INTRODUCTION.

About the middle of October, 1904, I received from Mr. A. D. Hardy, F.L.S., of the Lands Department, Melbourne, two slides of Algæ from the Yan Yean Reservoir, and their inspection revealed such a number of interesting species that I asked permission to examine more of the material. The sample had been obtained in February, 1904, about two hundred yards from the shore, and from the nature of the species observed I felt certain that the Algæ of the Yan Yean Reservoir would be well worth investigation.

Shortly afterwards, in response to my suggestion, Mr. Hardy very kindly consented to obtain for me periodical collections from this large sheet of water, and I have to tender him my best thanks for one of the most interesting and instructive series of collections I have yet examined. Mr. Hardy forwarded me, according to detailed instruction, samples of the plankton taken by boat at regular monthly intervals for thirteen months, in addition to samples from the weedy margin of the reservoir taken with the same regularity, and others from various parts of the drainage area. The value of these collections is greatly enhanced by records of the temperature, both of air and water, by remarks upon the meteorological conditions prevailing at the time of collecting and between the dates of collection, as well as by sundry information which has a bearing upon the distribution of Algæ in this district of Victoria.

The Yan Yean Reservoir *, which has a superficial area of about 1460 acres, furnishes part of the water-supply for the city of Melbourne, distant about 25 miles. Some of the water comes by an open aqueduct from the Toorourong Reservoir, a smaller body of water of 36 acres, supplied by small streams which, with their tributaries, drain a large portion of both the southern and northern slopes of the range of mountains dividing Victoria into a northern drier and a southern well-watered territory †. The formation of the reservoir began in 1853 by the construction of an embankment, five-eighths of a mile in length and 30 feet in height, to join the ends of low hills which form the south-westerly extremity of the catchment basin—an area of 4500 acres. The reservoir was completed in 1857, but only since 1883 has the main water-supply been along the aqueduct from the Toorourong Reservoir. The intake by this aqueduct is roughly about six times the amount received from the rainfall in the catchment basin ‡.

Much of the Toorourong supply is similarly obtained along an open channel,

---

* It may be of interest to know that the name "Yan Yean" is recorded as having been that of an Australian aboriginal chief, who signed the Batman Treaty (June 11, 1835), and means "boyish" or a "bachelor."

† A chart compiled by Mr. Hardy from data furnished by Mr. P. Baracchi, the Government Astronomer, clearly shows a wide difference in the rainfall of the northern as contrasted with the southern district. Prof. J. W. Gregory, however, does not recognize the dividing range, and from geological evidence states that, "in spite of geographers and biologists," the Great Dividing Range is a misleading geographical myth.

‡ The intake by aqueduct in 1903 was 5,984,000,000 gallons, and by rainfall in catchment basin was 1,021,953,000 gallons. In 1904 the figures were respectively 7,447,949,000 gallons and 1,125,326,000 gallons.

about 8 miles in length, partly natural and partly paved, which comes from the Wallaby Creek Weir, a dam at almost a thousand feet greater altitude. The water of the Wallaby Creek Weir is in a like manner partly brought along an open paved channel from a still higher dam, the Silver Creek Weir, distant about 5 miles.

A constant supply of water along the aqueduct to the Yan Yean Reservoir is assured by the dams at Toorourong, Wallaby Creek, and Silver Creek. The catchment area for the two upper dams is 11,500 acres, and the outflow streams find their way into King Parrot Creek. The catchment area of the Toorourong Reservoir is 10,500 acres, the water-supply from which is additional to that along the open channel from the upper dams, and the outflow of the reservoir is the east branch of the Plenty River.

The following records of the rainfall, although incomplete, indicate a great increase in the amount registered corresponding to a relatively small increase in altitude :—

		Yan Yean. Altit. 400 ft.	*Toorourong.* Altit. 736 ft.	*Wallaby Creek.* Altit. 1717 ft.	*Silver Creek.* Altit. 1740 ft.
		Catchment area 4500 acres.	Catchment area 10,500 acres.	Catchment area 11,500 acres.	
Registered rainfall	1903.	29·03 ins.	36·85 ins.	51·7 ins.	No records.
	1904.	26·67 „	33·75 „	56·39 „	
	1905.	29·63 „	—	—	

As the chief part of the water-supply of the Yan Yean Reservoir (some six-sevenths of the total volume) comes along the aqueduct from the Toorourong Reservoir, which is in turn largely supplied from the Wallaby Creek dam, it is therefore derived from a large area in which the rainfall is considerably greater than that which actually obtains in the Yan Yean catchment basin itself.

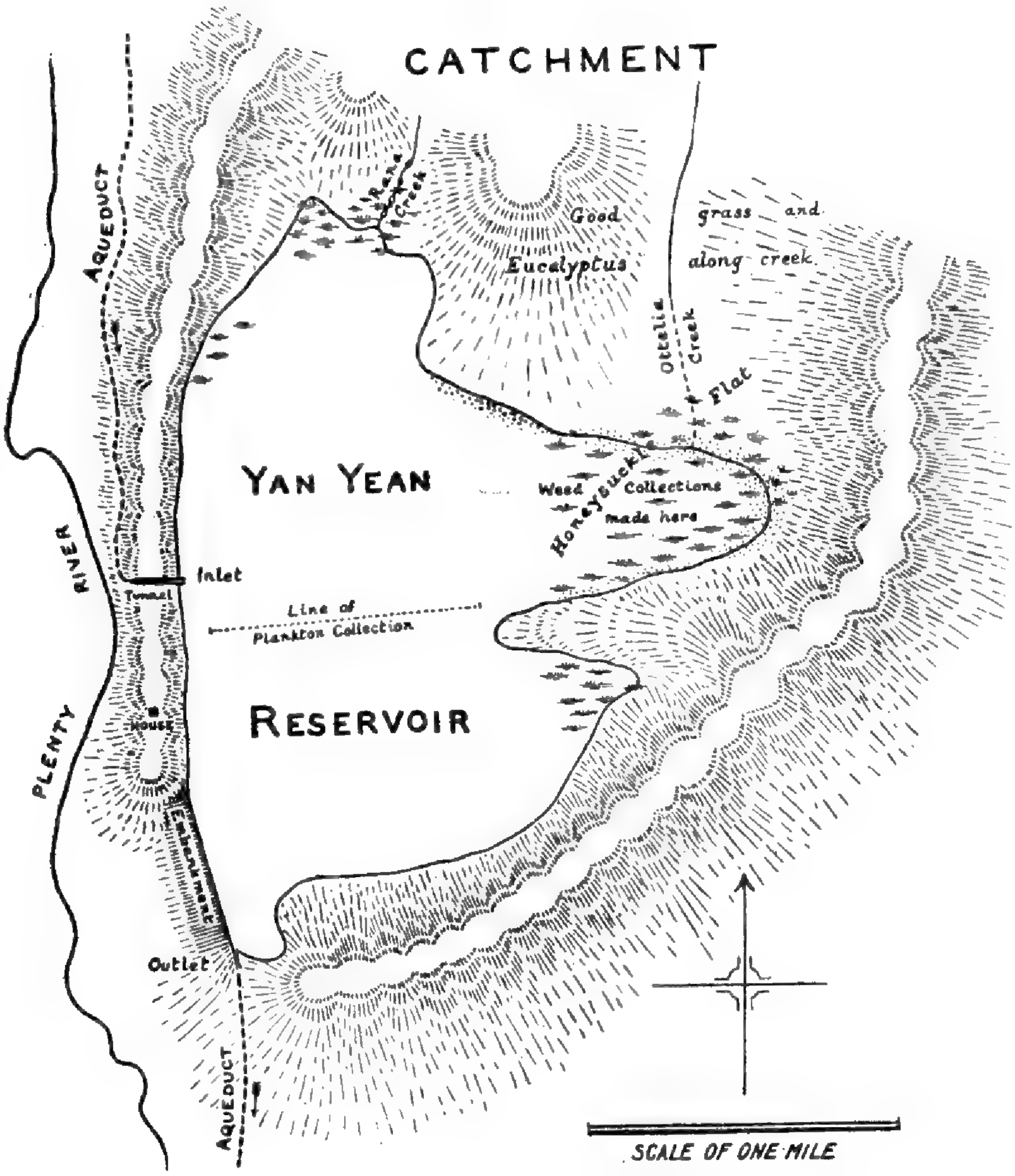
The full capacity of the reservoir is 6,400,000,000 gallons, and its average depth is a little over 24 feet.

The geological formations of the entire drainage area are Silurian and Granitic. The more distant supplies come from the granite of Mt. Disappointment (2630 feet), about 8 miles to the north, and the rest of the drainage is on outcrops of Silurian.

Some of the banks of the Yan Yean Reservoir are natural, others are stone-faced from below the low-level to above the high-water mark, and an embankment forms an artificial boundary at the south-west corner. The shores when gently sloping are weedy, but away from the margin the lake is fairly free from evident vegetation.

Mr. Hardy has furnished me with much information concerning the spermatophytic and pteridophytic flora of the district. He records *Prunella vulgaris, Bulbine bulbosa, Burchardia umbellata, Arthropodium strictum, Craspedia richea, Leptorhynchus tenuifolius, Drosera Menziesii, D. Whittakeri, Stackhousia linariifolia, Glycene clandestina, Eryngium vesiculosum, Stylidium graminiifolium, Aster* sp., *Helichrysum* sp., *Ranunculus lappaceus, R. aquatilis, Diuris sulphurea, D. maculata*, etc., as growing on the grassy slopes draining into the reservoir and sheltered by the pine plantation which almost surrounds it. On the remoter parts of these slopes a few native Australian shrubs and trees occur, such as *Exocarpus cupressiformis, Banksia marginata, Casuarina*

Fig. 1.


CATCHMENT
Rana Creek
Good grass and along creek
Eucalyptus
Ottelia Creek
Flat
AQUEDUCT
YAN YEAN
Weed Collections made here
Honeysuckle
RIVER
Inlet
Tunnel
Line of Plankton Collection
RESERVOIR
House
PLENTY
Embankment
Outlet
AQUEDUCT
SCALE OF ONE MILE

The Yan Yean Reservoir, showing the aqueduct from the Toorourong Reservoir, and the lower, swampy parts of the two creeks (Rana Creek and Ottelia Creek) in the catchment basin. The line of plankton collection is also indicated.

quadrivalvis, *Acacia melanoxylon*, *Eucalyptus globulus*, *E. citriodora*, *Hakea laurina*, etc. Mr. Hardy states that the few recent (Post-pliocene) deposits of the catchment area of the Yan Yean carry only stunted growths, and that the low-lying part of the Silurian country to the north is sparsely timbered with several kinds of *Eucalyptus*, but that the timber improves with increasing altitude, growing taller and straighter, while the undergrowth becomes denser. The gullies are rich in shrubs, and the creeks afford moisture for numerous ferns. Of the large tree-ferns, *Dicksonia Billardieri* and *Alsophila australis* are common, the brown trunks often being draped with *Hymenophyllum*. The shade-loving *Pteris incisa* and *P. tremula* are conspicuous, but *Pteris aquilina* is everywhere, while along the aqueduct between Wallaby and Silver Creeks *Gleichenia circinata* and species of *Lomaria* are abundant.

At the weedy margins of the Yan Yean the marsh plants are chiefly the rush-like *Heleocharis sphacelata* (the flowering shoots of which attain in places a length of eight feet), *Arundo Phragmites* (only in the N.W. corner), *Triglochin striata*, *Myriophyllum variifolium*, *Limnanthemum exaltatum*, and *Potamogeton natans*, the two latter almost monopolising small areas. Further out are *Potamogeton obtusus*, *Triglochin procera*, *Myriophyllum elatinoides*, *Vallisneria spiralis*, and a species of *Nitella* (about two feet in length). Flourishing among these larger plants there is an abundant littoral Alga-flora which will be considered in its relation to the phytoplankton.

Mr. Hardy's enthusiasm, combined with a sound knowledge of the requirements of the work he was so kindly undertaking for me, caused him to visit, at considerable trouble and inconvenience to himself, the different parts of the entire drainage area. Not only was this done for the collection of Algæ, but also for obtaining any information that might bear upon their distribution. He procured me samples of plankton from the Toorourong Reservoir, and from the dams at both Wallaby and Silver Creeks, for comparison with the Yan Yean plankton. In addition, he made a number of collections from different parts of the drainage area, especially in the vicinity of the two swampy inlets of the Yan Yean to which he has given the names of 'Rana Creek' and 'Ottelia Creek,' the former owing to the congregation of multitudes of frogs, and the latter by reason of the presence of *Ottelia ovalifolia* in most of the pools.

The present paper is divided into several chapters, of which the first three deal respectively with the phytoplankton of the Yan Yean Reservoir, the littoral Alga-flora, and the general Alga-flora of the drainage area. The Algæ of the entire area, and the different parts of it, are then discussed in their various relationships; the more important and interesting species are dealt with systematically; and lastly, attention is drawn to the peculiarities of the Alga-flora of Australasian freshwaters.

I. THE PHYTOPLANKTON.

General Notice.

The reports upon phytoplankton from the southern hemisphere are so far very few. The large lakes of Central Africa have been somewhat extensively explored *, but apart from these investigations the only other records are a few scanty notes on the limnetic flora of Lake Wakatipu, New Zealand †. The present report is therefore of great interest, not only because it constitutes the first plankton-investigation of Australian freshwaters, but also on account of the extended period over which the collections were made.

Detailed periodical investigations of plankton have been carried out in several parts of Europe, notably by Lemmermann, Schröder, Zacharias, and Volk in Germany, by Wesenberg-Lund in Denmark, by Chodat and Bachmann in Switzerland, and by Huitfeldt-Kaas in Norway. Other less comprehensive studies have been made of the lakes of Sweden, Austria, and the British Islands. Some excellent work has also been done in the United States, but more especially on the zooplankton.

The collections from the Yan Yean Reservoir show very clearly that the Australian plankton, when more fully investigated, will afford an interesting comparison with that of the temperate and subtropical regions of the northern hemisphere.

The plankton was collected in all cases along an easterly course, about a mile in length, across the middle of the lake, any part of the littoral region where weeds came near the surface being avoided. Mr. Hardy forwarded me two samples of each collection, one preserved in 3 per cent. formalin and the other in 4 per cent. potassium acetate (containing a trace of copper acetate).

In the tabulated account which follows, only those Algæ have been recorded which were fixed in the living condition. Empty individuals, obviously dead at the time of preservation, have been omitted.

The METEOROLOGICAL OBSERVATIONS accompanying the collections consisted of barometric and thermometric records, together with notes on the general condition of the weather at the times of collection and during the intervals between one collection and the next.

The *barometric readings* were taken by Mr. Wilson, the Resident Inspector, at 4 P.M. on the dates of collection, at which time a start was made to obtain the material, the temperatures being taken during the process of collection. The barometer was contained in a house about 100 feet above the surface of the lake, which is about 400 feet above sea-level, and the monthly readings indicate a remarkable uniformity of atmospheric pressure extending over a period of thirteen months.

---

* W. Schmidle, in Engl. Bot. Jahrb. xxvi. (1898); xxxii. (1903); xxxiii. (1904). G. S. West, in Journ. Linn. Soc., Bot. xxxviii. (1907).

† E. Lemmermann, in Abh. Nat. Ver. Bremen, Bd. xvi. Heft 2 (1899), pp. 338, 339.

Date.	Temp. of water.	Temp. of air.	Barometer.	Remarks on Weather.
1905. Feb. 4th ...	17·8° C. (=64° F.)	31·1° C. (=88° F.)	746·7 mm. (=29·4 ins.)	Fine warm day, with continuous sunshine; light wind causing a rippling of surface. Considerable rain two days previously.
Mar. 4th ...	18·5° C. (=65° F.)	22·8° C. (=73° F.)	749·2 mm. (=29·5 ins.)	Fine and sunny; light breeze ruffling the surface. No recent rain.
April 1st ...	17·8° C. (=64° F.)	13·3° C. (=56° F.)	758·1 mm. (=29·85 ins.)	Calm and cloudy; cold after frost; light wind gradually increasing in strength, and surface becoming choppy.
May 6th ...	18·9° C. (=66° F.)	22·8° C. (=73° F.)	749·2 mm. (=29·5 ins.)	Calm and sunny; surface smooth.
June 3rd ...	12·2° C. (=54° F.)	12·2° C. (=54° F.)	749·2 mm. (=29·5 ins.)	Cold and cloudy; surface smooth. A week's rain before the collection.
July 1st ...	10·0° C. (=50° F.)	12·2° C. (=54° F.)	749·2 mm. (=29·5 ins.)	Cold and sunny; wind strong and surface choppy. Rain preceding day.
Aug. 5th ...	10·0° C. (=50° F.)	15·0° C. (=59° F.)	751·7 mm. (=29·6 ins.)	Sunny, with strong N. wind; surface rough. Should have been the coldest month, but the N. wind made a relatively warm day. Water risen 2 feet owing to rains, and increased its area by about 30 acres.
Sept. 2nd ...	10·0° C. (=50° F.)	14·4° C. (=58° F.)	749·2 mm. (=29·5 ins.)	Dull and cloudy; surface at first smooth, but becoming ruffled with increasing wind. Preceding week very wet, and depth of water further increased.
Oct. 7th ...	12·2° C. (=54° F.)	11·1° C. (=52° F.)	776·1 mm. (=30·56 ins.)	Sunny, with light S. wind; surface rippled. Reservoir very full; preceding month with frequent rains and fall of snow.
Nov. 4th ...	15·0° C. (=59° F.)	15·6° C. (=60° F.)	744·1 mm. (=29·3 ins.)	Surface slightly rippled by W. wind. Copious rainfall during preceding month; reservoir very full, and vegetation of shores almost invisible.
Dec. 2nd ...	20·0° C. (=68° F.)	15·6° C. (=60° F.)	746·7 mm. (=29·4 ins.)	Storm of hail and rain immediately preceding the collection; preceding week warm, ending in tropical showers.
1906. Jan. 6th ...	23·3° C. (=74° F.)	35·6° C. (=96° F.)	751·7 mm. (=29·6 ins.)	Calm and hot; reservoir still full. Weather hot and dry during most of preceding month.
Feb. 10th ...	24·4° C. (=76° F.)	30·0° C.* (=86° F.)	749·2 mm. (=29·5 ins.)	Calm and hot; level of water falling slowly. Preceding month calm and hot.

* During the collection the temperature fell from 30·0° C. (86° F.) to 22·2° C. (72° F).

The *temperatures of the water* are surface temperatures taken at a depth of from six to twelve inches. The lowest recorded temperature was 10° C. (50° F.), which occurred on each of the three dates July 1st, Aug. 5th, and Sept. 2nd, 1905; the highest was 24·4° C. (76° F.) on Feb. 10th, 1906.

The *air-temperatures* naturally show a greater range of variation, from 11·1° C. (52° F.) on Oct. 7th, 1905, to 35·6° C. (96° F.) on Jan. 6th, 1906. On June 3rd, 1905, the temperatures of the air and water exactly coincided at 12·2° C. (54° F.).

In the accompanying chart (text-fig. 2) the thermometric observations are plotted out, and they show at a glance the smaller rise or fall of the temperature of the water corresponding to a greater rise or fall of the air-temperature. It will be noticed that in no instance does the recorded air-temperature fall below the minimum temperature of the water *. The

Fig. 2.

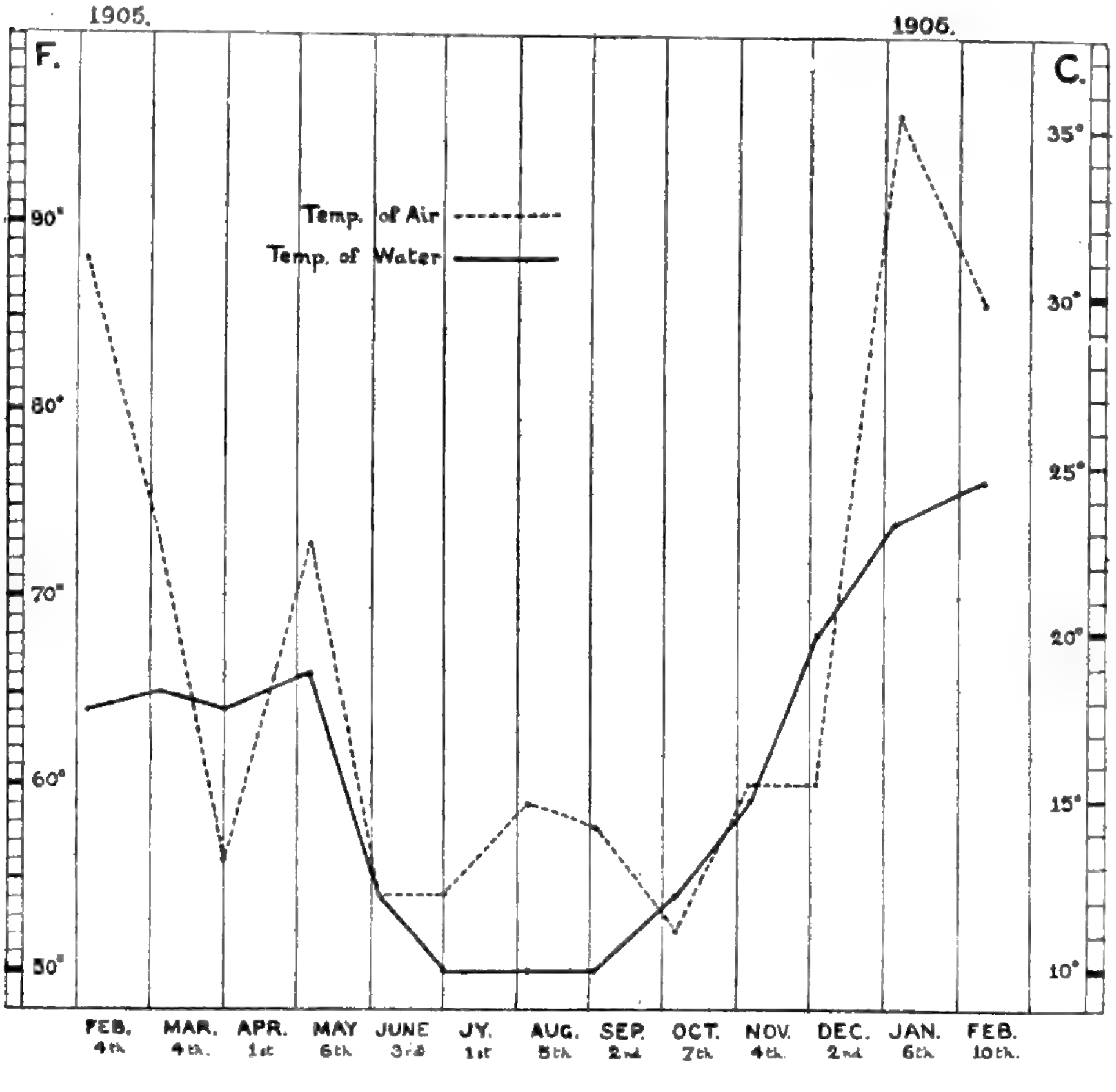


Chart showing the variations in the temperature of air and water at the Yan Yean Reservoir, Feb. 1905 to Feb. 1906.

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* This feature is due to the almost entire absence of prolonged frosts, and is not shown in a similar comparative series of observations relating to any lake in the temperate and more northerly parts of Europe, in which the record of air-temperatures would several times reach a minimum considerably lower than any shown in a correlated record of water-temperatures.

comparative coolness of the water relative to the maximum air-temperature is most probably due to the supply conveyed along the aqueduct from the dams fed by streams which drain the mountain slopes to the north. The constant influx of this cool water may also account for the slowness of the changes in temperature of the water following on considerable variations in the atmospheric temperature.

There is an average daily evaporation from the Yan Yean Reservoir of 1,197,000 gallons, or $\frac{1}{13}$ inch of the depth.

A chemical analysis of the Yan Yean water-supply furnished to Mr. Hardy by the Metropolitan Board of Works of Melbourne shows a somewhat unusual proportion of chlorides, but otherwise the data are in no way remarkable.

Chemical Analysis of Melbourne Water Supply.
[For year 1905 only.]
In parts per 1,000,000.

Where taken.	Date, 1905.	Total solid matter.	Free Ammonia.	Albuminoid Ammonia.	Oxygen consumed.	Chlorine.
Silver Creek	Nov. 1	53	0·010	0·064	2·80	14·0
Wallaby Creek	May 1	58	0·018	0·152	11·35	15·0
Toorourong Reservoir	May 1	78	0·038	0·212	9·35	17·5
	Nov. 1	74	0·028	0·134	5·30	19·0
Yan Yean Inlet	May 1	70	0·038	0·166	9·05	18·0
Yan Yean Outlet......	May 1	62	0·027	0·119	3·25	21·0
	Nov. 1	68	0·010	0·138	3·45	20·0

The Yan Yean Reservoir has a very rich phytoplankton, which reaches its greatest development in March and April, at the time when the Crustacea are least evident. The collections were made over precisely the same course on each occasion, and only from the open water away from the shore. I have regarded the material as true plankton as contrasted with the benthos which occurs at the weedy shores. The minimum amount of phytoplankton occurs in September and October, in which months it is almost wanting.

The most striking feature of the plankton is the richness of its Desmid-flora, in this respect offering a close comparison with the plankton of many of the lakes of the western British areas. This Desmid-flora is of exceptional interest because of the Australian types abundantly contained in it. The Desmids are dominant from about the middle of February to the end of April, reaching their greatest maximum in March and April, The most abundant and noteworthy forms are discussed in connection with their periodicity (consult page 19).

I ascribe the richness of this Desmid-flora to the nature of the geological formations upon which the Yan Yean Reservoir is situated, and from which it derives its water-supply. During the past sixteen years I have made a detailed study of the Desmidiaceæ, and, so far as Western Europe is concerned, the distribution of characteristic types, and also the richness of the Desmid-flora, has a close relationship with the geological formations of the drainage areas which may be under consideration [*]. The really rich Desmid-floras are only found on the Older Palæozoic and Precambrian formations [†]. The phytoplankton of lakes in these areas is much richer in the Desmidiaceæ than that of lakes situated on newer formations. Even the lakes of a Carboniferous area are poor as regards their Desmid-flora, unless part of the drainage is derived from outcrops of Silurian or of still older rocks. Outcrops of Igneous material also materially increase the richness of the Desmid-flora of a district.

It seems probable that one of the primary factors which brings about this richness of the Desmid-flora is the hardness and durability of the rocks constituting the older strata. The resistance of these rocks to subaërial denudation is due in a large measure to their antiquity; in other words, to the great compression they have been subjected to owing to weight of overlying strata, and to those movements in the earth's crust which have produced folding and contortion. The direct outcome of this action has been the production of mountainous regions which are suitable for the formation of peat-bogs; and wherever these conditions have been realized, there the Desmids flourish very well. They unquestionably thrive in suitable situations where the water contains small quantities of humic and other organic acids; but it seems probable that other chemical considerations play no small part in their distribution, otherwise it is difficult to account for those types which are apparently limited to the bogs and lakes of areas older than the Carboniferous.

With the one exception of *Melosira granulata*, the Diatoms are not very conspicuous. The complete absence of *Fragilaria* and *Asterionella* is a noteworthy feature [‡]. The comparative scarcity of Diatoms and the absence of some of the widely distributed plankton-genera is to be attributed to the relatively high temperature of the water, which was not below 10° C. at the time of collection on any occasion during the thirteen months over which the observations were made. Many of the European plankton-diatoms attain their maximum development at a temperature 5°–7° C. lower than the minimum temperature recorded for the water of the Yan Yean *.

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[*] This relationship is at present being worked out in detail in the British Islands, where we are particularly fortunate in having almost a complete succession of geological strata.

[†] W. West & G. S. West, "The Alga-flora of Yorkshire," Trans. Yorks. Nat. Union, v. (1901) p. 5; G. S. West, Treatise Brit. Freshw. Algæ (1904), p. 6.

[‡] The genera *Fragilaria* and *Asterionella* were entirely absent from the plankton of the large African lakes in which the mean temperature of the surface-water was above 20° C. *Cf.* G. S. West in Journ. Linn. Soc., Bot. xxxviii. (1907) pp. 84 and 88.

The great scarcity of Blue-green Algæ (Myxophyceæ) is one of the most remarkable peculiarities of the Yan Yean plankton. These Algæ play a most important part in the summer plankton of the shallower European lakes, in which the water attains a temperature no higher than that attained by the water of the Yan Yean, and, moreover, falls considerably lower in the winter months. They likewise constitute a large part of the plankton of the lakes of tropical Africa †, in which the surface-temperature of the water maintains an average equal to the highest summer temperature of the Yan Yean. As the Yan Yean Reservoir occupies an intermediate position between the lowland lakes of temperate regions and the lakes of the tropics with regard to its climatological conditions, but lacks the blue-green plankton-algæ so characteristic of both, it is possible that the chemical composition of the water has a direct influence on the growth of the blue-green plankton-algæ. In the light of this suggestion it is interesting to recall the fact that the Myxophyceæ constitute the principal vegetation of hot-springs ‡, in which the water may contain a great diversity of mineral constituents in solution.

Few Flagellates occurred in the Yan Yean plankton. *Mallomonas* and *Trachelomonas* were both absent, but two forms of *Dinobryon* were not at all uncommon.

MONTHLY STATEMENT OF PLANKTON FROM FEB. 1905 TO FEB. 1906.

Feb. 4th, 1905.—Desmids dominant, and a few scattered Crustacea (Copepods, *Bosmina*, and Nauplii). *Melosira granulata* and *Dinobryon cylindricum* var. *divergens* both common.

Mar. 4th, 1905.—Desmid-flora exceedingly rich; dominance due to great abundance of *Staurastrum corniculatum* and its var. *spinigerum*, *S. assurgens* var. *victoriense*, *S. longiradiatum*, *S. leptacanthum*, *S. muticum* var. *victoriense*, *Micrasterias Hardyi*, *Cosmarium capitulum* var. *australe*, *C. Hardyi*, *C. contractum*, and *C. contortum* forma *trigona*. Intermixed with the numerous Desmids were a few members of the Protococcoideæ, chiefly *Glœocystis gigas* and *Sphærocystis Schroeteri*. A few scattered Crustacea occurred, with many Nauplii. *Melosira granulata* was abundant, and the Flagellate *Dinobryon cylindricum*, with its var. *divergens*, was also very common.

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* *Vide* C. H. Ostenfeld & C. Wesenberg-Lund in Proc. Roy. Soc. Edinb. xxv. part xii. (1906) p. 1109.

† W. Schmidle, in Engl. Bot. Jahrb. xxxi. (1902); xxxiii. (1904). *Cf.* also G. S. West, *l. c.* pp. 89 and 90 (34 species of Blue-green Algæ recorded for the plankton of the three lakes Nyasa, Victoria Nyanza, and Tanganyika).

‡ W. H. Weed, "Formation of Travertine and Siliceous Sinter by the Vegetation of Hot Springs," Report U.S. Geol. Survey, 1887–88; G. S. West, "On some Algæ from Hot Springs," Journ. Bot., July 1902.

April 1st, 1905.—Desmids still dominant, the most abundant species being *Cosmarium Hardyi*; others in great abundance were *Staurastrum leptacanthum*, *S. longiradiatum*, *S. corniculatum* and its var. *spinigerum*, and *Micrasterias Hardyi*. *Peridinium Volzii* var. *australe* was not uncommon, but *Dinobryon* was rare. *Melosira granulata* still abundant, mostly with short filaments possessing the curious spines of var. *spinosa*, Schröder *. *Chroococcus limneticus* var. *subsalsus* was not infrequent; and the Crustacea were beginning to be more conspicuous.

May 6th, 1905.—Reduction in quantity of Desmids and also in number of species. The smaller species had almost vanished, but *Cosmarium Hardyi* and *Staurastrum leptacanthum* were not uncommon, and *Micrasterias Hardyi* was still abundant. *Melosira granulata* still fairly common, and the individuals of *Peridinium Volzii* var. *australe* are much larger, with thicker walls and more marked areolation of the plates. No *Dinobryon* was observed. The Crustacea now very evident, forming a relatively large amount of the plankton.

June 3rd, 1905.—Crustacea dominant. Few Desmids present, only odd specimens of *Micrasterias Hardyi* and a few other large species. Very little *Melosira granulata*. Quantity of *Sphærocystis Schroeteri*.

July 1st, 1905.—Crustacea dominant, and owing to mass of individuals actual bulk of plankton is increasing. *Micrasterias Hardyi* the only Desmid. *Sphærocystis Schroeteri* quite common. *Melosira granulata* distinctly scarce.

Aug. 5th, 1905.—This month the plankton reached its greatest bulk owing to the enormous abundance of Crustacea (*Daphnia*, *Bosmina*, *Cyclops*, and other genera). Phytoplankton almost wanting. *Melosira granulata* was rare, and a few specimens of *Micrasterias Hardyi*, *Staurastrum victoriense*, and *Desmidium Swartzii* were observed.

Sept. 2nd, 1905.—Crustacea still paramount, and actual bulk of plankton little less than in August. Desmids represented by a few isolated specimens of *Micrasterias Hardyi*. *Melosira granulata* rare, but the Diatoms were further represented by a few fine specimens of *Surirella robusta* var. *splendida*. The plankton contained quantities of the pollen-grains of Pines.

Oct. 7th, 1905.—Relative bulk of plankton only about half that obtained in August. Great diminution in numbers of Crustacea, and a plentiful admixture of Nauplii among the adults. Desmids rare. Very little *Melosira granulata*, but a few specimens of *Navicula bicapitata* could always be found. *Tetraspora lacustris* quite common, the colonies appearing to be young, some of them having rather a tough integument.

Nov. 4th, 1905.—The dominant constituents were Chlorophyceæ and Diatoms, but plenty of Copepods, *Bosmina*, and Nauplii were still present. Of the Chlorophyceæ, *Tetraspora lacustris* was most conspicuously abundant, the colonies being more expanded than in the preceding month and the mucous investment practically invisible. *Micrasterias Hardyi*, *Eudorina elegans,* and *Botryococcus Braunii* were all fairly abundant, and a few of the smaller Desmids were rare. *Volvox aureus* present in small quantity. Fragmentary filaments of small species of *Zygnema* and *Spirogyra* were not uncommon. Of the Diatoms, *Melosira granulata* was the most abundant, the filaments varying much in relative thickness. *Navicula viridis* was not at all uncommon, and next in order of frequency were *Navicula bicapitata* and *Surirella robusta* var. *splendida*. *Dinobryon cylindricum*, with its var. *divergens*, had again appeared in fair abundance.

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* B. Schröder in Ber. Deutsch. Bot. Ges. xv. (1897) p. 373, t. 17. f. 3.

Dec. 2nd, 1905.—Chlorophyceæ and Diatoms conspicuous, but Nauplii could almost be said to be dominant. *Micrasterias Hardyi* and *Volvox aureus* were the most conspicuous of the Chlorophyceæ, and *Melosira granulata* much the most abundant of the Diatoms. Schröder's spiny variety of the latter species was greatly in evidence. Few small Desmids. *Dinobryon cylindricum* var. *divergens* present in great abundance. A feature of this December plankton was the presence of an immense multitude of long unicellular hairs of vegetable origin, and most probably brought into the lake by the heavy rains of the preceding month. It has not been possible to determine from which plant these hairs were derived.

Jan. 6th, 1906.—The dominant constituents of the plankton were three species, one of each of the groups Bacillarieæ, Flagellata, and Chlorophyceæ. *Melosira granulata* and *Dinobryon cylindricum* var. *divergens* were present in great abundance, and *Pediastrum duplex* var. *reticulatum* occurred in almost as great a profusion. Many of the filaments of *Melosira granulata* had developed auxospores. The most interesting Diatom was *Rhizosolenia morsa*, which was quite common. *Crucigenia* and *Oocystis* make their first appearance after the colder weather. The smaller Desmids show signs of becoming quite common, but *Micrasterias Hardyi* was less abundant.

Feb. 10th, 1906.—The dominant feature was the quantity of *Melosira granulata*, with a plentiful sprinkling of thick filaments derived from the auxospores of the preceding month. *Dinobryon cylindricum* var. *divergens* occurred in quantity, but the colonies were mostly broken up. Larger Desmids were common (e. g., *Cosmarium Hardyi*, *Micrasterias Hardyi*, *Staurastrum longiradiatum*, etc.), but there was no evident increase in the number of the smaller species. The most interesting species of the Chlorophyceæ were *Lagerheimia splendens*, which was distinctly rare, *Kirchneriella lunaris*, and *Eudorina elegans*.

TABLE OF PHYTOPLANKTON.

The relative frequency of a species is indicated by the letters "ccc" = very abundant, "cc" = common, "c" = fairly common, "r" = infrequent, "rr" = rare, and "rrr" = very rare.

SPECIES.	1905.											1906.	
	Feb. 4th.	Mar. 4th.	Apr. 1st.	May 6th.	June 3rd.	July 1st.	Aug. 5th.	Sept. 2nd.	Oct. 7th.	Nov. 4th.	Dec. 2nd.	Jan. 6th.	Feb. 10th.
Chlorophyceæ.													
Oedogonium sp. (sterile)	...	...	...	...	...	...	...	...	...	r			
Mougeotia sp. (probably *M. victoriensis*)	c	r	...	...	rr	r	rrr	...	rr	rrr	r		
Spirogyra sp. (probably *S. gracilis*)	...	...	...	...	...	rrr	...	...	...	r			
Zygnema sp. (probably *Z. spontaneum*)	...	...	...	...	...	...	...	...	rr	rr	rr	rr	rrr
Gonatozygon monotænium, De Bary	...	...	...	...	...	...	...	...	...	rr	rr	r	
,, *Kinahani*, (Arch.) Rabenh.	...	rrr	...	...	rrr	r							
Closterium Kützingii, Bréb.	rr	rr	...	...	...	...	...	...	rr	...	...	...	rr
Pleurotænium mamillatum, G. S. West	rrr	r	rrr										
Micrasterias Hardyi, G. S. West	cc	cc	ccc	c	r	c	rr	r	rr	cc	ccc	c	rr
Cosmarium obsoletum, (Hantzsch) Reinsch	...	...	rr	rrr	...	...	...	...	...	...	...	rrr	
,, *Lundellii*, Delp.	...	...	rrr										
,, *granatum*, Bréb.	...	...	rr										
,, *moniliforme*, (Turp.) Ralfs, var. *limneticum*, W. & G. S. West	r	c	r	r	rr	rr	rrr	...	...	...	...	...	rr
,, *contractum*, Kirchn.	rr	c	c	c	...	...	...	...	...	...	rrr	rr	r
,, ,, var. *ellipsoideum*, (Elfv.) W. & G. S. West	r	cc	r	rr	...	r	rr	rrr	rr	r	c	r	r
,, *bioculatum*, Bréb.	r	c	...	...	rr	...	...	...	...	...	rrr	rr	r
,, *perfissum*, sp. n.	...	rr	rr	rrr									
,, *achondroides*, sp. n.	rr	r	r	r	...	rr	rrr	...	...	r	rr		
,, *pseudoprotuberans*, Kirchn.	...	...	...	...	...	...	...	...	...	...	...	cc	
,, *bireme*, Nordst.	...	...	...	...	...	...	...	...	...	...	...	r	
,, *capitulum*, Roy & Biss., var. *australe*, G. S. West	c	ccc	r	r	...	...	...	...	...	rrr	rr	r	
,, *tortum*, Nordst. & Lagerh., forma *trigona*	cc	ccc	cc	...	...	...	...	...	...	...	rr	r	rr

Cosmarium impressulum, Elfv.	...	rrr	rrr	...	...	...	...	...	...	...	...	c	
,, *turgidum*, Bréb., var. *ovatum*, Nordst.	...	...	rr										
,, *Regnesi*, Reinsch	...	...	rrr	...	...	...	...	...	...	...	...	r	
,, *Blyttii*, Wille	...	...	...	...	...	...	...	...	...	...	...	r	
,, *subtriordinatum*, W. & G. S. West, forma	rrr	rr	...	...	...	...	...	...	...	...	...	...	rrr
,, *quadrum*, Lund.	...	...	rrr										
,, *Hardyi*, G. S. West	rr	c	ccc	r	...	rr	rrr	rrr	...	rr	rr	rr	cc
Xanthidium hastiferum, W. B. Turn., forma	...	rr	r										
Arthrodesmus Incus, (Bréb.) Hass., forma *a*	...	...	...	rrr	...	...	...	...	...	...	..	rr	rr
,, ,, forma *b*	..	...	...	...	...	...	...	...	...	...	...	rr	rr
Staurastrum cuspidatum, Bréb.	r	cc	c	r	...	rr	...	...	...	rr	rrr	r	rr
,, *dejectum*, Bréb.	rr	r	r	rrr	...	...	...	...	...	...	...	...	rrr
,, *mucronatum*, Ralfs, var. *delicatulum*, G. S. West	cc	cc	r	...	...	...	...	...	...	...	...	...	r
,, *corniculatum*, Lund.	cc	cc	cc	rr	...	rrr	...	...	...	rrr	...	..	rr
,, ,, var. *spinigerum*, West	cc	cc	cc	...	...	...	...	...	...	...	...	...	r
,, *grande*, Bulnh.	...	rr	...	...	...	...	...	...	...	rr			
,, *muticum*, Bréb.	c	c	c	...	...	rr	rrr						
,, ,, var. *victoriense*, G. S. West	rr	c	c	c	rr	rrr	...	...	...	...	...	...	rrr
,, *lanceolatum*, Arch.	...	...	...	...	...	...	...	...	...	...	...	...	rrr
,, *lævispinum*, Biss., var. *subbrachiatum*, G. S. West	...	r	r										
,, *victoriense*, sp. n.	rrr	rr	rrr	rrr	rrr	rr	rrr	...	rrr	r	r	rrr	rrr
,, *leptacanthum*, Nordst.	c	c	c	r	rr	rrr	...	...	...	...	...	rr	r
,, *furcatum*, (Ehrenb.) Bréb.	...	...	rrr										
,, *senarium*, (Ehrenb.) Ralfs	...	rr	rr	rrr									
,, *patens*, W. B. Turn., var. *planctonicum*, G. S. West	rrr	r	rr	r									
,, *Avicula*, Bréb., var. *subarcuatum*, (Wolle) West	...	...	...	rrr									
,, *hexacerum*, (Ehrenb.) Wittr., var. *aversum*, W. & G. S. West	...	...	...	...	...	...	...	...	...	...	...	rr	
,, *tetracerum*, Ralfs	...	c	r	r	...	...	...	...	...	...	...	r	rr
,, *excavatum*, W. & G. S. West, forma	rr	rr	rrr	rrr	...	...	...	...	...	...	...	c	c
,, *assurgens*, Nordst., var. *victoriense*, var. n.	...	rr	rr	r	...	rrr	...	...	...	...	...	...	rr
,, *indentatum*, W. & G. S. West, forma	...	...	r	...	...	...	...	...	...	...	...	...	r
,, *paradoxum*, Meyen, var. *longipes*, Nordst.	rrr	rr	r	...	...	...	...	...	...	...	...	...	rrr
,, *longiradiatum*, W. & G. S. West	r	c	c	r	...	...	...	...	...	rr	r	r	c
,, *sagittarium*, Nordst.	...	rrr											
,, *sexangulare*, (Buln.) Rabenh.	rrr	r	rr	...	...	...	...	...	...	...	...	...	rrr
,, ,, var. *productum*, Nordst.	rrr												
Spondylosium papillosum, W. & G. S. West	...	rr	rr										
Sphærozosma excavatum, Ralfs	...	rr	...	rr									
,, *Aubertianum*, West, var. *Archerii* (Gutw.), W. & G. S. West.	...	...	...	...	...	...	...	...	...	...	rrr		

TABLE OF PHYTOPLANKTON (*continued*).

SPECIES.	1905.											1906.	
	Feb. 4th.	Mar. 4th.	Apr. 1st.	May 6th.	June 3rd.	July 1st.	Aug. 5th.	Sept. 2nd.	Oct. 7th.	Nov. 4th.	Dec. 2nd.	Jan. 6th.	Feb. 10th.
Chlorophyceæ (*cont.*).													
Onychonema filiforme, (Ehrenb.) Roy & Biss.	...	...	...	rrr									
Hyalotheca dissiliens, (W. Sm.) Bréb.	...	...	...	...	...	rr							
,, *mucosa*, (Dillw.) Ehrenb.	...	...	rrr	...	...	rrr	rrr	...	...	...	rrr		
Desmidium Swartzii, Ag.	...	rrr	rr	rr	rr	rrr	rr	...	...	...	...	...	rrr
,, *Baileyi*, (Ralfs) Nordst., var. *undulatum*, (Mask.) Nordst.	...	...	...	rrr									
Volvox aureus, Ehrenb.	...	...	...	...	...	...	...	...	...	c	c		
Eudorina elegans, Ehrenb.	...	rrr	rrr	rr	...	...	rrr	...	...	cc	c	...	rr
Pandorina Morum, (O. F. Müll. ?) Bory	...	...	...	...	...	...	...	...	...	...	rrr	rr	
Pediastrum duplex, Meyen, var. *clathratum*, A. Br.	...	c											
,, ,, ,, *reticulatum*, Lagerh.	rr	r	...	...	...	...	...	...	...	...	rr	ccc	c
Cœlastrum microporum, Näg.	...	...	...	...	...	...	...	...	...	rr	...	...	rrr
Crucigenia rectangularis, (Näg.) F. Gay	...	...	...	...	...	...	...	...	...	...	...	rrr	
Scenedesmus bijugatus, (Turp.) Kütz.	rr	r	...	...	...	...	...	...	...	...	...	rr	rrr
Ankistrodesmus falcatus, (Corda) Ralfs	rrr	r	r	...	...	...	...	...	...	...	...	r	rr
,, ,, var. *biplex*, (Reinsch) G. S. West	...	...	rr										
,, ,, var. *spiralis*, (W. B. Turner) G. S. West	...	rrr	rrr										
Closteriopsis longissima, Lemm.	...	c	rr										
Kirchneriella lunaris, (Kirchn.) Möb.	rrr	...	rr	...	...	...	...	...	...	...	...	rr	rr
Oocystis lacustris, Chodat	...	...	...	...	...	...	...	...	...	...	...	rr	rr
,, *parva*, W. & G. S. West	...	...	...	...	...	...	...	...	...	...	...	rr	
Nephrocytium lunatum, West	...	...	...	...	...	...	...	...	...	...	rrr	rrr	
Lagerheimia splendens, sp. n.	...	...	...	...	...	...	...	...	...	...	...	...	rr
Dictyosphærium pulchellum, Wood	r	cc	c	r									
Botryococcus Braunii, Kütz.	...	...	...	r	c	c	r	...	rrr	r	r	rr	rr
Glœocystis gigas, (Kütz.) Lagerh.	r	c	c	c	...	...	...	...	...	...	...	rr	r
Sphærocystis Schroeteri, Chodat	rr	r	r	c	cc	ccc	r	rr					
Tetraspora lacustris, Lemm.	...	...	...	...	...	...	...	r	cc	ccc	cc		

Bacillarieæ.													
Melosira granulata, Ralfs	cc	ccc	cc	r	rr	rr	rrr	rrr	r	cc	ccc	ccc	ccc
,, ,, var. *spinosa*, Schröd.	rrr	cc	ccc	r									
Cyclotella stelligera, Cleve & Grun.	...	...	...	...	...	rr							
Rhizosolenia morsa, W. & G. S. West	...	...	...	...	...	...	...	...	...	...	...	c	
Tabellaria flocculosa, (Roth) Kütz.	rr	rrr	rrr	rrr	rrr	rrr	...	rrr	rrr	rr	rrr	rr	rr
Synedra Ulna, (Nitzsch) Ehrenb.	...	...	...	...	...	rr	rr	r	rr				
,, ,, var. *splendens*, (Kütz.) Van Heurck	...	...	..	...	...	...	...	...	...	...	...	...	rrr
Cocconeis Placentula, Ehrenb.	...	...	...	r	...	rr							
Navicula viridis, Kütz.	...	...	...	...	...	...	...	...	rr	r			
,, *bicapitata*, Lagerst. (a form)	...	...	...	rrr	...	...	...	...	rr	c			
Vanheurckia viridula, Bréb.	...	...	rr	rrr	...	rrr							
Gyrosigma elongatum. W. Sm., var. ?	..	...	...	...	...	...	...	...	...	rrr			
Gomphonema gracile, Ehrenb.	r												
,, *constrictum*, Ehrenb.	...	...	...	...	...	rrr							
Rhopalodia gibba, (Kütz.) O. Müll.	...	...	...	rr									
Nitzschia curvula, (Ehrenb.) W. Sm.	...	...	...	...	...	rrr							
,, *Palea*, (Kütz.) W. Sm.	...	...	...	...	...	...	...	...	...	r			
Surirella robusta, Ehrenb., var. *splendida*, (Ehrenb.) Van Heurck	...	r	r	...	...	r	rr	rr	...	r			
,, *ovalis*, Bréb.	...	...	...	...	...	...	...	...	...	rrr			
Myxophyceæ.													
Anabæna sp. (sterile)	...	...	...	rrr	...	r							
Plectonema sp. ? (fragmentary)	...	...	...	...	...	...	...	...	...	rr			
Oscillatoria Agardhii, Gom.	...	...	...	...	...	c	r	...	...	...	rr		
Chroococcus limneticus, Lemm., var. *subsalsus*, Lemm.	rr	r	c										
Peridinieæ.													
Peridinium Volzii, Lemm., var. *australe*, var. n.	...	...	rr	rr	...	...	...	...	...	c	r	r	c
Flagellata.													
Dinobryon cylindricum, Imhof	c	ccc	rr	...	...	rr	...	...	...	cc	c	c	cc
,, ,, var. *divergens*, (Imhof) Lemm.	r	ccc	r	...	...	...	...	...	...	c	ccc	ccc	
,, *elongatum*, Imhof, var. *undulatum*, Lemm.	...	r											

Dominant Forms and their Periodicity.

Flagellata.—Two species and two varieties of the genus *Dinobryon* formed a characteristic part of the plankton. They attained their maximum very rapidly, occurring in abundance from February (or even December) to March, with a water-temperature of 18°–20° C. All the forms disappeared with equal rapidity, and were entirely absent from May to October. The occurrence of *Dinobryon* only in the warmer part of the year is a fact which calls for special mention. In the British lakes this genus reaches its maximum in spring, generally in May, at a time when the temperature of the surface-water is little more than half the average summer temperature. This is in agreement with the observations of Tanner-Fullemann on the occurrence of *Dinobryon* in certain of the Swiss alpine lakes *, and Ostenfeld

Fig. 3.

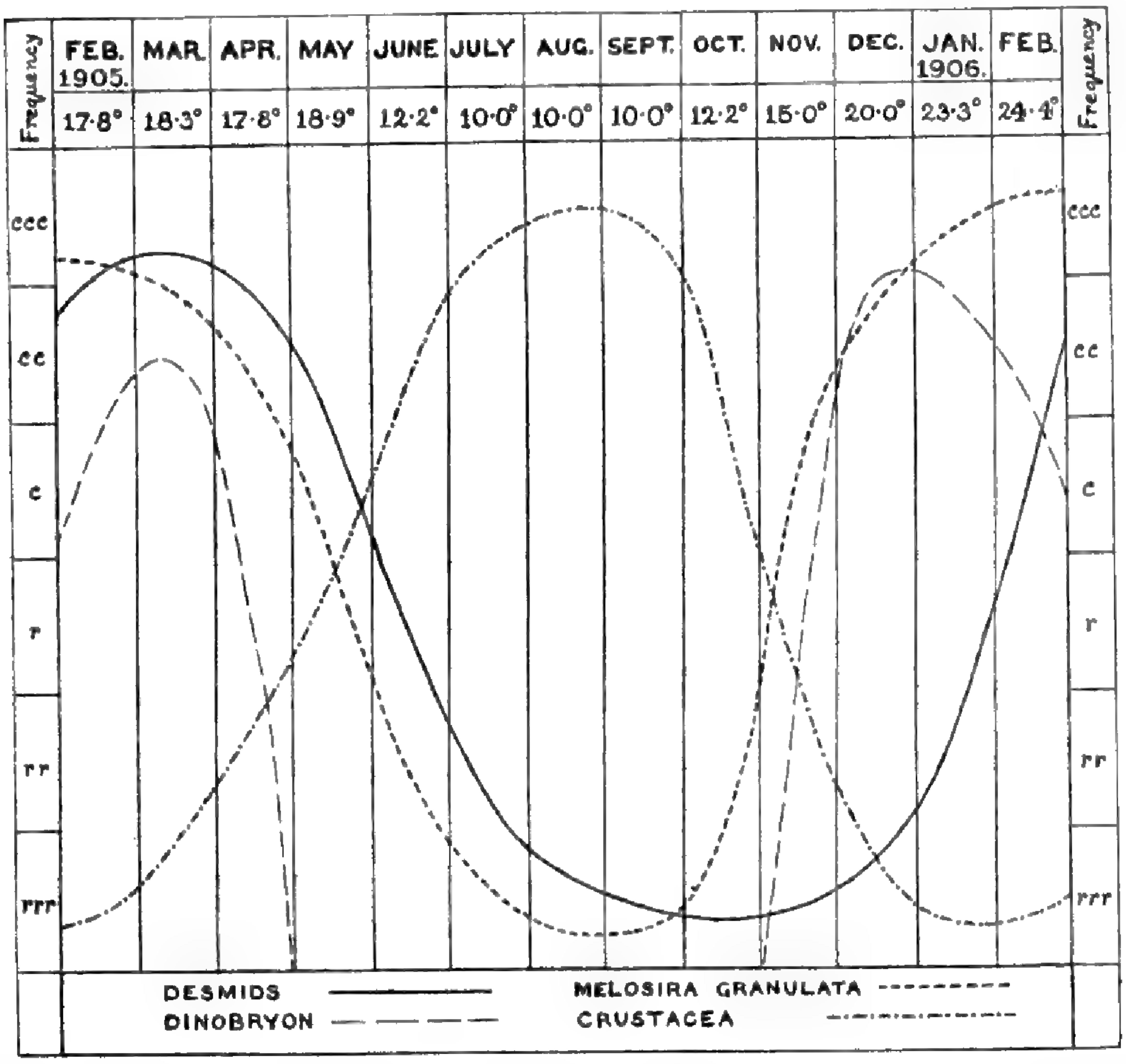

Chart showing the periodicity of the dominant constituents of the Yan Yean plankton. The relative frequency is indicated by the same lettering as in the Table of Phytoplankton.

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* M. Tanner-Fullemann, in Bull. de l'Herb. Boissier, 2me sér., vii. (1907) p. 226. [Max. development in May with a water-temperature of 11° C.]

and Wesenberg-Lund [*] state that *Dinobryon* is a prominent feature of lakes of higher altitudes in which the temperature of the water is never very high. In the Danish lakes, Wesenberg-Lund [†] also finds the maximum to occur in May. In the "Altwässer" of the Danube, Brunnthaler [‡] records the maximum of *D. Sertularia* var. *thrysoideum* as occurring in January, that of *D. cylindricum* var. *divergens* in May, and that of *D. sociale* in June. In the Yan Yean plankton the maximum of *D. cylindricum* (and also its var. *divergens*) occurs from 18°–20° C., whereas in the European plankton the maximum is attained at a temperature below 15° C. In the lakes of tropical Africa, with a mean surface temperature of over 20° C., *Dinobryon* is entirely absent [§].

Peridinieæ.—Only one species of this group occurred in the plankton. This form, *Peridinium Volzii* var. *australe*, which is of great interest from a classificatory point of view, had two maxima, the first in November, with a temperature of 15° C., and the second in February, with a temperature of 24·4° C.

Chlorophyceæ.—Fragments of *Mougeotia* were not uncommon, but no coiled filaments were observed such as occur in the British freshwater plankton. *The dominant Chlorophyceæ are Desmids.* From February to May the plankton has all the characters of a Desmid-plankton. They attain their maximum from February to April, at a time when the temperature of the water is at its highest and when the Crustacea are least in evidence. The most conspicuous of these Desmids is *Micrasterias Hardyi*, a handsome species which up to the present is only known to occur in this one lake [‖]. It is never absent from the plankton, and appears to have two maxima: the first in April (temp. 17·8° C.), and the second in December (temp. 20° C.). *Cosmarium Hardyi*, with its maximum in April, and *C. contractum* are both conspicuous constituents of the plankton, especially the former. *Staurastrum leptacanthum* is common from February to April, and the extraordinary *S. victoriense*, although always a scarce constituent, was only absent from the plankton in September. In all, 58 species of Desmids occurred in the plankton, many of them abundantly. *Volvox aureus* and *Eudorina elegans* were present in November and December, the latter also occurring very sparingly at other times of the year. The former may be only a casual, but the latter is a true plankton-alga both here and in Europe. *Botryococcus Braunii* occurred only in June and July. *Sphærocystis Schroeteri* occurred from February to September, attaining its maximum from June to July. In the systematic part of this paper I have given reasons for considering this Alga and *Tetraspora lacustris* as different stages of one and the same organism (consult page 75). The *Tetraspora*-stage commenced in October and reached its maximum in November. Wesenberg-Lund *, from the experience of his Danish plankton investigations, states that he is inclined to believe that the two are not identical.

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[*] C. H. Ostenfeld & C. Wesenberg-Lund, in Proc. Roy. Soc. Edin. xxv. part xii. (1906) p. 1098.

[†] C. Wesenberg-Lund, "Studier over de Danske Söers Plankton," Dansk. Ferskv.-Biol. op. 5, Kjöbenhavn, 1904, p. 115 ("Summary," p. 26).

[‡] J. Brunnthaler, in Verh. der k.k.zool.-bot. Ges. Wien (1907), p. 185.

[§] G. S. West, in Journ. Linn. Soc., Bot. xxxviii. (1907) p. 84.

[‖] This species may occur in other parts of Victoria, or of Australasia, but Mr. Hardy's careful collections have failed to reveal its presence in any other part of the Yan Yean drainage area. Should *Micrasterias Hardyi* be restricted to this one lake, it will afford a parallel to the occurrence of *M. Murrayi*, W. & G. S. West, in the plankton of Loch Ruar, Sutherland. (*Vide* W. & G. S. West, in Journ. Linn. Soc., Bot. xxxv. (1903) p. 538.)

Fig. 4.

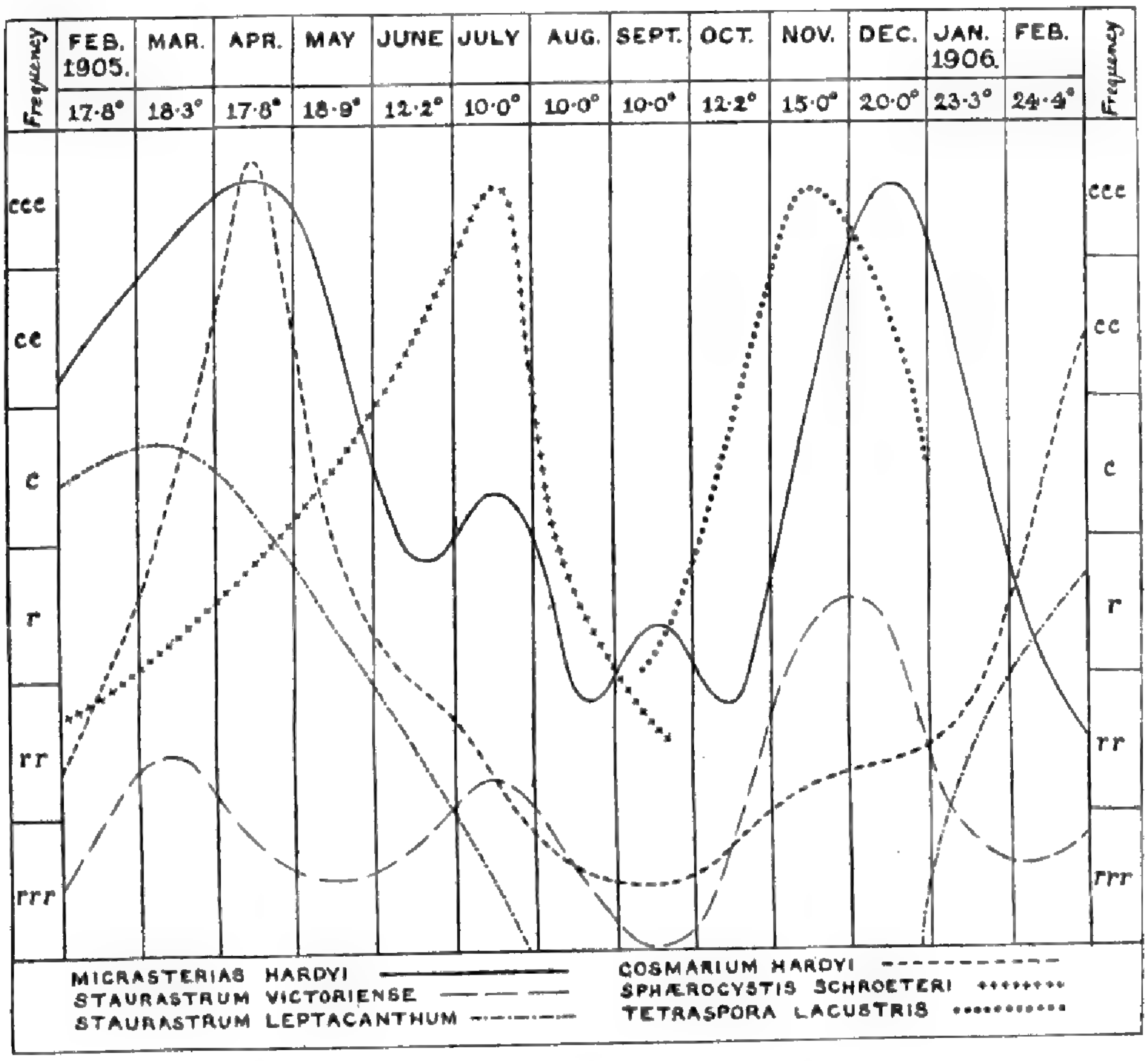

Chart showing the periodicity of six of the characteristic Chlorophyceæ of the Yan Yean plankton.

Bacillarieæ.—Diatoms are not a feature of the Yan Yean plankton, although *Melosira granulata* occurs abundantly and is never absent from the collections. It is most conspicuous from November to April, and reaches its maximum in February, when the temperature of the water averages 21° C. Auxospore-formation took place in January ; that is to say, at approximately the period of highest temperature *. No coiled filaments were observed such as occur in the plankton of certain European lakes. *Rhizosolenia morsa* occurred abundantly in January (temp. of water 23·3° C.), but was not observed in any other month. As in the British plankton †, this Diatom is apparently a summer (or warm-water) species with a very brief vegetative period. Of the Naviculaceæ, *Navicula bicapitata* was common in November, and *Vanheurckia viridula* was scarce from April to July. Both these species are shore forms and occurred abundantly in the benthos ; but it is worthy of note that the plankton-specimens of the latter species were of much greater size than those observed from any other situation. Species of *Gyrosigma* are not infrequently met with in the freshwater plankton, but the species which occurred in the November plankton of the Yan Yean is of more than ordinary interest. It occurred very sparingly, and it is much more nearly allied to certain of the marine species of the genus than to any of the known freshwater species. For the present I have regarded it as possibly a variety of *Gyrosigma elongatum* (consult p. 79). *Tabellaria flocculosa*, although never frequent, was present in all the collections except those made in August.

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* C. Wesenberg-Lund, *l. c.* [*cf.* p. 19] (1904) p. 21 of Summary.

Myxophyceæ.—The remarkable scarcity of Blue-green Algæ has already been commented upon. *Oscillatoria Agardhii* was common in July, and *Chroococcus limneticus* var. *subsalsus* occurred abundantly in April. There is no phase of the plankton in which Blue-green Algæ dominate such as occurs in so many European ‡ and N. American lakes §.

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* In the report upon the plankton of Thingvallavatn, Iceland, C. H. Ostenfeld & C. Wesenberg-Lund record the auxospore-formation of *Melosira islandica* as commencing rather suddenly between the middle of December and the middle of January (temp. 1°–2° C.); *vide* Proc. Roy. Soc. Edin. xxv. part xii. (1906) p. 1117. This is in striking contrast to the auxospore-formation of *M. granulata* in the Yan Yean at a temp. of 23·3° C.

† W. West & G. S. West, in Trans. Roy. Soc. Edin. xli. part iii. (1905) p. 509; Trans. Roy. Irish Acad. xxxiii. sect. B, part ii. (1906) p. 109.

‡ Consult B. Schröder, "Das Pflanzenplankton preussischer Seen," Westpreuss. Bot.-Zool. Verein, Danzig (1900), p. 73 ; E. Lemmermann, "Das Phytoplankton einiger Plöner Seen," Forschungsb. Biol. Stat. Plön, x. (1903) p. 126 ; K. v. Keissler, in Oesterr. botan. Zeitschr. (1906) no. 5–6, p. 4 ; H. Huitfeldt-Kaas, 'Planktonundersogelser Norske Vande,' Christiania (1906), p. 152 ; and many others.

§ C. Dwight Marsh, in Bull. Wisconsin Geol. and Nat. Hist. Survey, Sci. ser. 3, xii. p. 15 ; and others.

II. THE LITTORAL ALGA-FLORA (OR MICROPHYTIC BENTHOS).

General Notice.

Although careful investigations have been carried out on the phytoplankton of many lakes, more especially in Europe and North America, very few detailed observations have been made on the benthos of these lakes with a view to discovering the relationships between the littoral species and those of limnetic habit. Such observations, to be of any real worth, necessarily demand a very extensive preliminary training in systematic work, and some of the recent publications exhibit only too clearly an insufficient knowledge of the plants dealt with. In many cases this has resulted in conclusions having been put forward which are of very doubtful value.

Among the weeds at the margins of the Yan Yean Reservoir, and especially in the vicinity of Honeysuckle Flat, there is a prolific Alga-flora which constitutes the microphytic part of the benthos and affords an interesting comparison with the phytoplankton. The collections were made periodically on the same day as the plankton-collections, and the variations of temperature, both of the water and the atmosphere, can be regarded as approximately the same as those tabulated in respect of the phytoplankton.

The large weedy tract of the eastern bay of the lake, to which Mr. Hardy has given the name of Honeysuckle Flat, appears to be the principal recruiting ground for many species found in the plankton, and the periodic collections from among the weeds were all made in this swampy area. Numerous wild fowl, such as ducks, coot, teal, black swans, herons, cormorants, etc., haunt this weedy flat, and deposit much excreta, some of which forms in the shallower parts a greasy scum on the surface. As the diet of these water-fowl is largely one of perch, blackfish, trout, etc., the mud of the reservoir must be considerably enriched by additional phosphates. The weed-collections were always made outside the feeding-ground of the water-fowl, generally from unnibbled weeds in from two to five feet of water. The coating of Algæ was most evident on *Triglochin procera*, *Potamogeton obtusus*, *Heleocharis sphacelata*, and *Myriophyllum variifolium*; and some of the larger species of the genus *Staurastrum* (especially *S. leptacanthum* and *S. victoriense*) were more than ordinarily prolific on the leaves of *Vallisneria spiralis*.

As is commonly the case, and would naturally be expected, the algal species observed among the littoral macrophytes were considerably more numerous than those found in the plankton.

MONTHLY STATEMENT OF THE MICROPHYTIC BENTHOS FROM FEB. 1905 TO JAN. 1906.

Feb. 4th, 1905.—Desmids dominant, with few Myxophyceæ and Diatoms. The Protococcoideæ were only represented by a few specimens of *Pediastrum Tetras.*

Mar. 4th, 1905.—Desmids dominant, mostly small species. Zygospores of *Cosmarium contractum* not uncommon. A species of *Chytridium* was abundant, parasitic on certain species of *Cosmarium.* A decided increase in the number of Protococcoideæ.

April 1st, 1905.—Desmids dominant, having reached their maximum abundance. The most conspicuous species were *Cosmarium obsoletum* and *Staurastrum senarium.* Diatoms numerous. A species of *Anabæna* occurred and showed indications of spore-formation. Sterile species of *Mougeotia* not uncommon.

May 6th, 1905.—Desmids still dominant, but great diminution in the bulk of the material. Much decomposition had taken place, and the material consisted largely of decaying organic matter. The *Anabæna* sp. was still evident, but the filaments were in a very fragmentary condition.

June 3rd, 1905.—Desmids very abundant, especially *Cosmarium contractum* and its var. *ellipsoideum, Staurastrum muticum, S. corniculatum, S. leptacanthum,* and *S. victoriense.* Diatoms few as regards individuals, but 20 species represented.

July 1st, 1905.—Desmids dominant and most of them in a state of active division. The most conspicuous were *Staurastrum cuspidatum, S. muticum, S. victoriense, S. assurgens,* and *Cosmarium contractum* var. *ellipsoideum.* The Myxophyceæ were represented by quantities of *Oscillatoria Agardhii* and somewhat fragmentary filaments of the same species of *Anabæna* as occurred in April and May. Number of Diatoms increased, more especially due to the multitude of individuals of some of the smaller species.

Aug. 5th, 1905.—Desmids practically disappeared; only living ones were *Closterium Venus, Staurastrum cuspidatum,* and *S. sagittarium,* all of which were very scarce. Various dead and half-decayed remains of numerous species were conspicuous. The other Chlorophyceæ have also disappeared. One solitary *Volvox* colony was seen. Diatoms more numerous and more conspicuous; especially noticeable were the large individuals of *Eunotia major* var. *bidens.* A few Crustacea were present, and also a Tardigrade (a small sp. of *Macrobiotus*).

Sept. 2nd, 1905.—No Chlorophyceæ observed. Fewer Diatoms than in preceding month, both of species and individuals. Rather more of the small Crustacea than in August.

Oct. 7th, 1905.—A few Chlorophyceæ had made their appearance, mostly Desmidiaceæ. A few of the smaller Desmids were not uncommon, and *Cosmarium amœnum* var. *mediolæve* was conspicuous. Filaments (sterile) of a small species of *Mougeotia* were not infrequent. A few Diatoms were fairly general, and *Vanheurckia viridula* was abundant.

Nov. 4th, 1905.—The littoral Alga-flora very rich. Five species of *Oedogonium* and one of *Bulbochæte* with ripe oospores. *Zygnema spontaneum* and five species of *Mougeotia* in fruiting condition, of which *M. subcrassa* and *M. victoriensis* are interesting new species. *Spirogyra gracilis* in conjugation. Protococcoideæ represented by a multitude of small species. Also a vast number of very small species of Desmids, of which *Cosmarium capitulum* var. *australe*, *C. quadratulum*, and *Staurastrum bibrachiatum* var. *cymatium* were particularly conspicuous. Diatoms numerous, but species relatively few.

Dec. 2nd, 1905.—Three species of *Oedogonium* and one of *Bulbochæte* were in a fruiting condition. Large quantities of sterile filaments of *Zygnema spontaneum*, and a few with zygospores, were observed. Intermingled with the *Zygnema* were fruiting specimens of *Mougeotia subcrassa* and *Spirogyra gracilis*. Small species of Desmids were very numerous, and one specimen of *Micrasterias Hardyi* was observed. There were a number of Protococcoideæ, of which *Glœocystis gigas* was the most conspicuous, while species of *Scenedesmus* and *Cœlastrum sphæricum* were fairly general. The conspicuous Diatoms were *Tabellaria flocculosa*, *Vanheurckia viridula*, and *Synedra Acus*. *Dinobryon cylindricum* (with its var. *divergens*) was abundant, and *Trachelomonas hispida* was not uncommon. The dominant feature was the enormous abundance of the smaller species of Desmids.

Jan. 6th, 1906.—The amount of *Zygnema*, *Mougeotia*, and *Oedogonium* greatly diminished. The most interesting Conjugate was *Debarya Hardyi* in all stages up to the formation of ripe zygospores. The smaller species of Desmids were still abundant, although not quite so numerous as in the preceding month. *Gonatozygon monotænium* was conspicuously abundant. One specimen of *Micrasterias Hardyi* was again observed. Of the Protococcoideæ, *Ankistrodesmus* and *Scenedesmus* were the most frequent. There was a considerable increase in the number of Diatoms, more especially in individuals. The species of Diatoms were few, *Synedra Ulna* and *Tabellaria flocculosa* being the most conspicuous. The dominant features were the two Diatoms just mentioned and the numerous small species of Desmids. Many species of *Cosmarium* (especially *C. obsoletum*) and the zygospores of *Spirogyra gracilis* were attacked by *Myzocytium proliferum*, Schenk, one of the Chytridiaceæ.

TABLE OF LITTORAL ALGA-FLORA.

As in the tabulated list of phytoplankton, the relative frequency of a species is indicated by the letters "ccc"= very abundant, "cc"= common, "c"= fairly common, "r"= infrequent, "rr"= rare, and "rrr"= very rare.

SPECIES.	1905.											1906.
	Feb. 4th.	Mar. 4th.	Apr. 1st.	May 6th.	June 3rd.	July 1st.	Aug. 5th.	Sept. 2nd.	Oct. 7th.	Nov. 4th.	Dec. 2nd.	Jan. 6th.
Chlorophyceæ.												
Oedogonium cryptoporum, Wittr.	...	...	...	...	...	...	...	...	...	c	r	
,, ,, var. *vulgare*, Wittr.	...	...	...	...	...	...	...	...	...	r	r	
,, *oblongum*, Wittr.	...	...	...	...	...	...	...	...	...	c	r	
,, *platygynum*, Wittr.	...	...	...	...	...	...	...	..	...	rr		
,, *flavescens*, (Hass.) Wittr.	...	...	...	...	...	...	...	...	...	rr	rr	
,, *suecicum*, Wittr., forma *australis*	...	...	...	...	...	...	...	...	...	rrr		
,, *undulatum*, (Bréb.) A. Br.	...	...	...	...	...	...	...	...	...	rr		
,, *monile*, Berk. & Harv., forma *victoriense*	...	...	...	...	...	...	...	...	...	...	r	
Bulbochæte crassiuscula, Nordst.	...	...	...	...	...	...	...	...	...	...	r	rr
,, *subintermedia*, Elfv.	...	...	...	...	...	...	...	...	...	rr		
Coleochæte irregularis, Pringsh.	rr	rr										
Ulothrix idiospora, sp. n.	...	...	...	...	...	...	...	...	...	r		
Mougeotia parvula, Hass., var. *angusta*, (Hass.) Kirchn.	...	...	...	...	...	...	...	...	...	rrr		
,, *victoriensis*, sp. n.	...	...	...	...	...	...	...	...	...	cc		
,, *recurva*, Hass.	...	...	...	...	...	...	...	...	...	rr		
,, *subcrassa*, sp. n.	...	...	...	...	...	...	...	...	...	r	rrr	
,, *viridis*, (Kütz.) Wittr.	...	...	...	...	...	...	...	...	r			
Debarya Hardyi, sp. n.	...	...	...	...	...	...	...	...	...	...	...	r
Zygnema spontaneum, Nordst.	...	...	...	...	...	...	...	...	...	cc	c	r
Spirogyra gracilis, (Hass.) Kütz.	...	...	...	...	...	...	...	...	...	r	r	rr
Gonatozygon monotænium, De Bary	...	r	...	rr	rr	...	...	...	...	...	r	ccc
,, *Brébissonii*, De Bary	...	...	...	...	...	...	...	...	...	rrr	rrr	
,, *Kinahani*, (Arch.) Rabenh.	...	...	rrr	...	rrr							
Cylindrocystis diplospora, Lund.	rrr	r	r	...	...	...	...	...	...	...	rrr	

TABLE OF LITTORAL ALGA-FLORA (*continued*).

SPECIES.	1905.											1906.
	Feb. 4th.	Mar. 4th.	Apr. 1st.	May 6th.	June 3rd.	July 1st.	Aug. 5th.	Sept. 2nd.	Oct. 7th.	Nov. 4th.	Dec. 2nd.	Jan. 6th.
Chlorophyceæ (*cont.*).												
Closterium macilentum, Bréb.	...	...	...	...	rr							
,, *Dianæ*, Ehrenb.	...	rrr	...	...	rrr							
,, *parvulum*, Näg.	...	...	...	...	rr							
,, ,, var. *angustum*, W. & G. S. West	...	rrr	rrr	r	...	...	...	...	...	...	rr	rr
,, *Venus*, Kütz.	rrr	rrr	rrr	rr	r	r	rr	...	...	...	rrr	
,, *calosporum*, Wittr.	rrr	rrr										
,, *incurvum*, Bréb.	...	...	...	...	...	...	...	...	...	rr	rr	rrr
,, *Lunula*, (O. F. Müll.) Nitzsch	...	...	rrr	...	...	rrr						
,, *aciculare*, T. West, var. *subpronum*, W. & G. S. West.	...	...	...	...	...	...	...	...	...	...	rrr	rrr
Pleurotænium Ehrenbergii, (Bréb.) De Bary	...	...	...	...	...	...	...	...	...	rrr		
,, *mamillatum*, G. S. West	...	...	...	...	...	rrr						
,, *coronatum*, (Bréb.) Rabenh.	...	...	...	...	...	...	...	...	...	...	...	rrr
,, *ovatum*, Nordst., var. *tumidum*, Mask.	...	...	...	...	...	...	...	...	...	rrr	rrr	
,, *nodosum*, (Bail.) Lund.	...	...	...	...	...	...	...	...	...	rrr	rrr	
Triploceras gracile, Bail., var. *aculeatum*, Nordst., forma	...	rrr										
,, ,, var. *robustum*, var. n.	...	...	...	...	...	...	...	...	...	...	...	rr
,, ,, var. *denticulatum*, (Playfair) nob.	...	rrr										
Euastrum denticulatum, (Kirchn.) F. Gay, forma	...	...	r	rr	rr	rr	...	...	...	...	rr	rr
,, *crispulum*, (Nordst.) W. & G. S. West	...	rr	rrr									
,, *Turnerii*, West, forma *minor*	...	...	...	rrr	...	...	...	...	rr	cc	cc	c
Micrasterias Hardyi, G. S. West	...	...	...	...	...	...	...	...	...	...	rrr	rrr
Cosmarium obsoletum, (Hantzsch) Reinsch	rr	r	cc	c	c	r	...	...	...	...	rrr	rrr
,, *dorsitruncatum*, (Nordst.) nob.	r	r	r	...	...	...	...	...	rrr			
,, *granatum*, Bréb.	...	rr	r	...	...	rrr	...	...	...	rr	r	c
,, *moniliforme*, (Turp.) Ralfs	...	...	rr									
,, ,, var. *limneticum*, W. & G. S. West	...	...	r	rr	r	c	...	...	...	rrr	r	
,, *affine*, Racib., var. *excavatum*, var. n.	...	rrr										
,, *tinctum*, Ralfs	...	...	...	...	...	...	...	...	...	...	rrr	
,, *contractum*, Kirchn.	rr	r	r	rr	c	rr	...	...	...	...	rr	rr
,, ,, var. *ellipsoideum*, (Elfv.) W. & G. S. West	...	cc	cc	ccc	ccc	r	...	...	...	...	r	

Cosmarium tjibenongense, Gutw., forma	...	...	...	...	rrr							
" *bioculatum*, Bréb.	rr	c	r	r	r	c	...	...	rr	r	c	
" *perfissum*, sp. n.	...	r	r	rr	rr	rr	...	...	...	...	rrr	
" *achondroides*, sp. n.	...	rr	r	r	cc	r	...	...	...	r	rr	
" *abbreviatum*, Racib.	...	...	rr	rr	r	r	...	...	rr	c	r	rr
" *pygmæum*, Arch.	rr	c	r	...	...	...	...	...	...	cc	c	r
" *pseudoprotuberans*, Kirchn., var. *angustius*, Nordst.	...	...	...	...	...	...	...	...	...	...	r	rr
" *sexangulare*, Lund., forma *minima*, Nordst.	...	...	...	...	...	...	...	...	...	...	rr	rrr
" *bireme*, Nordst.	...	...	...	...	...	...	...	...	...	rr	r	
" *Phaseolus*, Bréb., forma	...	c	r	...	rr	r	...	...	...	...	rr	rr
" *capitulum*, Roy & Biss., var. *australe*, G. S. West	...	cc	c	...	rrr	rrr	...	...	...	ccc	cc	c
" *Murrayi*, Playfair	...	...	...	...	...	...	...	...	...	rrr		
" *Regnellii*, Wille	...	rrr	...	rrr	...	...	...	...	...	rr	rrr	
" *angulosum*, Bréb.	...	r	...	...	r	...	...	...	...	cc	c	r
" " var. *concinnum*, (Rabenh.) W. & G. S. West	...	rr	r	...	...	...	...	...	...	...	c	rr
" *quadratulum*, (F. Gay) De Toni	...	...	...	...	...	...	...	...	...	ccc	cc	c
" *difficile*, Lütkem., var. *sublæve*, Lütkem.	rr	r	r	r	rr	rrr	...	...	...	...	...	rrr
" *impressulum*, Elfv.	...	...	rrr	...	...	...	...	...	...	c	c	r
" *venustum*, (Bréb.) Arch., var. *induratum*, Nordst.	...	...	...	...	...	...	...	...	...	...	...	rrr
" *gonoides*, W. & G. S. West, var. *subturgidum*, W. & G. S. West.	...	...	...	...	...	r						
" *Regnesi*, Reinsch	...	...	...	...	...	...	...	...	...	r	r	rrr
" *abruptum*, Lund., var. *granulatum*, W. & G. S. West	...	...	...	...	...	...	...	...	...	...	rr	rrr
" *Blyttii*, Wille	...	...	...	...	...	...	...	...	...	r	rr	r
" *subpunctulatum*, Nordst.	...	rrr	...	rrr	rrr	rrr	...	...	...	...	rr	
" *subtriordinatum*, W. & G. S. West, forma	...	rr	rr	r	...	...	...	...	...	rr	r	rrr
" *amænum*, Bréb., var. *mediolæve*, Nordst.	c	r	rr	rr	r	rrr	...	...	r	rr	rrr	rr
" *Hardyi*, G. S. West	...	...	rrr	rrr								
" *binum*, Nordst.	...	rrr	rrr	r	rr	rrr						
Xanthidium hastiferum, W. B. Turn., forma	...	rr	...	rr	rrr							
Arthrodesmus Incus, (Bréb.) Hass., forma *a*	...	rr	rr	rr	rr	...	...	...	...	...	...	rrr
" " forma *b*	...	...	...	...	...	...	...	...	...	...	...	rrr
" *triangularis*, Lagerh.	...	...	...	...	...	...	...	...	...	rr		
" " forma *minor*	...	...	r	rr	rrr	...	...	...	...	rr	rr	rrr
Staurastrum cuspidatum, Bréb. [inclus. var. *divergens*, Nordst.]	r	ccc	c	c	r	ccc	rrr	...	...	r	r	rr
" *dejectum*, Bréb.	r	cc	c	r	rr	...	...	...	...	rr	rr	rrr
" *Dickiei*, Ralfs	...	rr	rrr									
" *mucronatum*, Ralfs, var. *delicatulum*, G. S. West	...	...	...	rrr	...	rr						
" *corniculatum*, Lund.	...	r	c	r	cc	c						
" " var. *spinigerum*, West	...	c	c	...	rr	rr						
" *grande*, Bulnh.	...	...	rr	...	rrr	rrr						

TABLE OF LITTORAL ALGA-FLORA (*continued*).

SPECIES.	1905.											1906.
	Feb. 4th.	Mar. 4th.	April 1st.	May 6th.	June 3rd.	July 1st.	Aug. 5th.	Sept. 2nd.	Oct. 7th.	Nov. 4th.	Dec. 2nd.	Jan. 6th.
Chlorophyceæ (*cont.*).												
Staurastrum muticum, Bréb.	...	rr	cc	c	ccc	c						
,, *Bieneanum*, Rabenh.	...	...	...	...	...	rrr						
,, *lanceolatum*, Arch.	...	...	rrr	...	...	...	...	...	rrr	rrr	rrr	rr
,, *digitatum*, sp. n.	...	rrr	rr									
,, *victoriense*, sp. n.	...	...	rrr	r	c	cc						
,, *leptacanthum*, Nordst.	...	r	r	c	cc	r						
,, *furcatum*, Ehrenb.	...	r	c	r	c	c						
,, *senarium*, (Ehrenb.) Ralfs	rr	rr	c	r	rrr	rrr						
,, *unicorne*, W. B. Turn., var. *nodiferum*, (W. B. Turn.) W. & G. S. West.	...	rrr										
,, *punctulatum*, Bréb.	rrr	rr										
,, *dilatatum*, Ehrenb., var. *obtusilobum*, De Not.	...	...	r	...	...	...	...	...	...	...	rrr	rr
,, *alternans*, Bréb.	...	...	...	...	...	rr	...	...	...	...	rr	rrr
,, *hexacerum*, (Ehrenb.) Wittr.	rr	c	r	...	...	rrr	...	...	...	cc	c	c
,, ,, var. *aversum*, W. & G. S. West	...	...	...	...	...	...	...	...	...	...	c	c
,, *polymorphum*, Bréb.	...	...	...	...	...	...	...	...	...	...	...	rrr
,, *cyrtocerum*, Bréb.	rrr	r										
,, *neglectum*, sp. n.	...	rrr	r	rr	...	rrr						
,, *tetracerum*, Ralfs	...	c	...	rrr	rrr	c	...	...	...	c	rr	c
,, *bibrachiatum*, Reinsch, var. *cymatium*, W. & G. S. West	...	...	...	...	...	rrr	...	...	...	cc	r	rr
,, *excavatum*, W. & G. S. West, forma	...	c	r	...	rrr	rr	...	...	...	cc	c	rr
,, *Hardyi*, sp. n.	...	...	...	...	...	rr	...	...	...	c	cc	r
,, *assurgens*, Nordst., var. *victoriense*, var. n.	r	cc	cc	c	c	c	...	...	...	...	r	r
,, *indentatum*, W. & G. S. West, forma	...	rr	r	rr	rr	rr						
,, *leptocladum*, Nordst.	rrr	r	...	...	...	...	...	...	...	rrr		
,, *longiradiatum*, W. & G. S. West	...	...	rrr	rr	...	rr	...	...	...	rr	r	r
,, ,, var. *subnudum*, var. n.	...	...	...	...	...	...	...	...	...	...	c	rr
,, *sagittarium*, Nordst.	rrr	rr	rrr	...	...	...	rrr	...	...	rrr	rrr	rrr
,, *sexangulare*, (Bulnh.) Rabenh.	...	...	rrr	...	...	...	...	...	rrr	rrr	rrr	rr
Spondylosium secedens, (De Bary) Arch.	...	rrr										

Sphærozosma excavatum, Ralfs	...	...	...	...	rrr							
,, *Wallichii*, Jacobsen, forma *australis*	...	...	...	...	...	rrr						
,, *Aubertianum*, West	...	...	...	...	rrr	rrr	...	...	...	r	rr	r
Onychonema filiforme, (Ehrenb.) Roy & Biss.	rr	rr	rr	rrr	rr	rr	...	...	...	rrr	rr	c
Hyalotheca dissiliens, (W. Sm.) Bréb.	...	...	...	...	...	...	...	...	...	...	rrr	
,, *hians*, Nordst.	...	...	...	...	...	...	...	...	...	...	rrr	
,, *mucosa*, (Dillw.) Ehrenb.	...	...	...	rrr								
Desmidium Swartzii, Ag.	...	rr	rrr	...	...	rr						
,, *aptogonum*, Bréb.	...	...	...	...	...	...	...	...	...	...	...	r
,, *Baileyi*, (Ralfs) Nordst., var. *undulatum*, (Mask.) Nordst.	r	rrr	rrr	...	...	rrr	...	...	...	rr	r	c
Volvox aureus, Ehrenb.	...	...	...	...	...	...	rrr					
Eudorina elegans, Ehrenb.	...	...	...	...	...	...	...	...	...	...	rrr	
Pandorina Morum, (O. F. Müll.) Bory	...	...	...	...	...	...	...	...	...	rrr	rr	rrr
Gonium pectorale, O. F. Müll.	...	...	...	...	...	...	...	...	...	rr		
Pediastrum duplex, Meyen, var. *reticulatum*, Lagerh.	...	...	...	...	...	...	...	...	...	...	rr	r
,, *Boryanum*, (Turp.) Menegh.	...	...	...	...	...	rrr	...	...	...	...	rr	r
,, *Tetras*, (Ehrenb.) Ralfs	rrr	rr	...	...	...	...	...	...	...	rr	r	rrr
Cœlastrum sphæricum, Näg.	rrr	...	...	...	...	r	...	...	...	...	r	rrr
,, *microporum*, Näg.	...	...	...	...	...	...	...	...	...	rrr	r	
Crucigenia rectangularis, (A. Br.) Gay	...	...	...	...	rrr							
Scenedesmus bijugatus, (Turp.) Kütz.	...	rr	...	...	...	r	...	...	...	c	rr	c
,, *obliquus*, (Turp.) Kütz.	...	...	...	...	...	...	...	...	...	...	...	r
,, *acutiformis*, Schröder	...	...	...	...	...	...	...	...	...	...	rr	r
,, *denticulatus*, Lagerh., var. *linearis*, Hansg.	rr	r	rr	rr	rr	c	...	...	...	r	...	c
,, *quadricauda*, (Turp.) Bréb.	...	...	...	...	...	...	...	...	...	...	...	rr
Ankistrodesmus falcatus, (Corda) Ralfs	rr	r	rr	r	r	c	...	...	...	c	r	r
,, ,, var. *acicularis*, (A. Br.) G. S. West	...	rr	...	...	r	r	rrr	...	...	...	rr	c
,, ,, var. *spiralis*, (W. B. Turn.) G. S. West	...	...	...	rrr	...	rr	...	...	...	...	rrr	rr
Oocystis solitaria, Wittr.	...	rr	...	...	...	rr	...	...	...	cc	c	r
,, *submarina*, Lagerh., forma *major*	...	rr										
Nephrocytium Agardhianum, Näg.	...	...	...	...	...	...	...	...	...	...	...	rrr
,, *lunatum*, West	...	rr	rr	...	...	rrr	...	...	...	r	r	r
Tetraëdron minimum, (A. Br.) Hansg.	...	r	...	...	rr	r	rr	...	...	...	c	
,, *caudatum*, (Corda) Hansg.	...	...	...	...	...	...	...	...	...	...	...	rrr
,, *octaëdricum*, (Reinsch) Hansg.	...	rrr	rrr									
Dictyosphærium pulchellum, Wood	...	...	rrr	rrr	rr	r	...	...	...	rr	rrr	
Glœocystis gigas, (Kütz.) Lagerh.	rr	r	...	...	...	...	...	...	...	...	c	r
,, *vesiculosa*, Näg.	...	rrr	...	...	...	...	...	...	...	...	rrr	
,, *infusionum*, (Schrank) W. & G. S. West	...	...	...	...	...	...	...	...	...	...	...	rrr
Sphærocystis Schroeteri, Chodat	...	...	...	...	...	...	...	...	...	...	c	c
Schizochlamys gelatinosa, A. Br.	...	...	rr									

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Bacillarieæ.												
Melosira granulata, Ralfs	...	c	...	...	r	...	rr	...	...	...	rrr	rr
Cyclotella Meneghiniana, Kütz.	...	...	...	...	...	...	c	rr				
,, *stelligera*, Cleve & Grun.	...	...	...	...	...	...	rrr	...	...	...	r	rr
Tabellaria flocculosa, (Roth) Kütz.	c	r	rr	r	...	...	r	ccc	...	cc	cc	ccc
Diatoma elongatum, Ag.	...	...	...	...	...	...	...	rr				
Synedra Ulna, (Nitzsch) Ehrenb.	rr	rr	...	...	rr	r	...	r	...	...	...	c
,, *Acus* (Kütz.) Grun.	rr	r	...	...	r	c	c	...	...	cc	c	rr
Eunotia major, (W. Sm.) Rabenh., var. *bidens*, (Greg.) Van Heurck	rr	rr	...	...	...	rr	c	...	...	...	...	rrr
,, *gracilis*, (Ehrenb.) Rabenh.	...	...	...	...	...	...	...	...	...	...	rr	
,, *crispula*, sp. n.	...	rrr	...	...	rr							
,, *lunaris*, (Ehrenb.) Grun.	...	...	...	...	...	...	r	...	...	c	r	r
Achnanthes linearis, W. Sm.	...	...	...	...	...	c						
Cocconeis Placentula, Ehrenb.	r	cc	c	c	cc	c	r	...	rr	...	...	rrr
Navicula major, Kütz.	rr	r	r	...	rr	...	r	...	...	...	rrr	
,, *viridis*, Kütz.	...	...	...	...	rrr							
,, *cardinalis*, Ehrenb.	...	...	...	...	...	...	...	...	...	...	rr	
,, *borealis*, (Ehrenb.) Kütz.	...	...	...	...	...	...	rrr					
,, *bicapitata*, Lagerstedt, var.	...	r	...	rr	...	...	r	...	...	r	...	rrr
,, *mesolepta*, Ehrenb., var.	...	...	...	...	...	...	rr					
,, *radiosa*, Kutz., var. *acuta*, (W. Sm.) Van Heurck	...	rr	r	r	r	c	cc	rr				
,, ,, var. *tenella*, (Bréb.) Van Heurck	...	...	...	r	r	r	c					
Stauroneis Phœnicenteron, Ehrenb.	...	rr	...	...	rrr	...	r					
,, *anceps*, Ehrenb.	...	...	...	...	rrr							
Vanheurckia rhomboides, (Ehrenb.) Bréb.	...	...	...	...	...	rr	rrr					
,, *viridula*, Bréb.	c	cc	c	c	cc	cc	cc	rrr	ccc	r	c	c
Gyrosigma attenuatum, (Kütz.) Rabenh., forma	...	...	...	...	rr							
Gomphonema gracile, Ehrenb.	...	...	...	...	...	...	...	...	...	...	rr	r
Cocconema lanceolatum, Ehrenb.	...	...	...	...	rr	r						

Cocconema ventricosum, (Kütz.) G. S. West	...	...	...	...	...	...	rr					
,, *gracile*, (Rabenh.) G. S. West	rr	r	r	r	r	c	cc	r	...	...	...	rrr
Epithemia turgida, (Ehrenb.) Kütz.	...	rr	rrr									
,, *Sorex*, Kütz.	...	rrr										
Rhopalodia gibba (Kütz.) O. Müll.	...	rrr	rrr	rr	rrr							
Nitzschia Palea, (Kütz.) W. Sm.	rr	r	r	r	r	c	cc	...	...	...	...	rr
,, *Sigma*, (Kütz.) W. Sm.	...	rrr	...	...	rr	rr	rr	...	...	rr		
,, *curvula*, (Ehrenb.) W. Sm.	...	rr										
,, *vermicularis*, (Kütz.) Grun.	. .	...	...	...	...	r	r					
Hantzschia Amphioxys, (Ehrenb.) Grun.	...	...	...	...	...	...	...	...	...	...	rrr	
Surirella robusta, Ehrenb.	...	rr	r	...	...	rr	rr					
,, ,, var. *splendida*, (Ehrenb.) Van Heurck	...	...	rr	rr	rr	r						
,, *linearis*, W. Sm.	...	...	...	...	rrr							
Myxophyceæ.												
Glaucocystis Nostochinearum, Itzigsh.	...	...	rr									
Anabæna sp. (sterile)	...	r	c	c	rr	rr						
Rivularia sp. (fragmentary)	...	rr	r									
Lyngbya perelegans, Lemm.	rrr	rr	r	r	...	...	...	...	...	...	r	rrr
Oscillatoria tenuis, Ag.	...	...	rrr	rrr	rr							
,, *Agardhii*, Gom.	...	...	...	...	...	cc						
Glæothece linearis, Näg.	rrr	rr										
Tetrapedia Reinschiana, Arch.	...	...	...	...	...	rr	...	...	...	...	rr	
Gomphosphæria lacustris, Chodat	...	...	...	...	...	r	...	...	...	...	...	rrr
Chroococcus minimus, (Keissler) Lemm.	rrr	rrr										
Peridinieæ.												
Glenodinium cinctum, Ehrenb.	...	...	...	...	...	...	...	...	...	...	rr	
Peridinium inconspicuum, Lemm.	...	...	...	...	...	...	...	...	...	r	cc	r
,, *Volzii*, Lemm., var. *australe*, var. n.	...	...	...	rrr	...	...	...	...	...	...	rrr	
Flagellata.												
Dinobryon cylindricum, Imhof	...	...	...	...	...	...	...	...	...	r	r	
,, ,, var. *divergens*, (Imhof) Lemm.	...	...	...	...	...	...	...	...	...	...	c	rrr
,, *elegantissimum*, sp. n.	...	...	...	...	...	...	...	...	...	...	...	rrr
,, *protuberans*, Lemm.	...	...	...	...	...	...	...	...	...	...	rr	
,, *elongatum*, Imhof, var. *undulatum*, Lemm.	...	...	...	...	...	...	...	...	...	...	...	rrr

Dominant Forms and their Periodicity.

Flagellata.—The genus *Dinobryon* was not so abundant as in the plankton, although *D. cylindricum* var. *divergens* was common in December. *D. elegantissimum* is an interesting stipitate form which was very scarce in January. *Trachelomonas hispida* occurred sparingly several times during the year.

Peridinieæ.—Two species occurred in the warmer part of the year, but only one, *P. inconspicuum*, was abundant, occurring in quantity in December. *P. Volzii* var. *australe* was observed very sparingly in both May and December, months in which the temperature was approximately the same.

Chlorophyceæ.—From February to July the Desmids were the dominant feature of the benthos, and they attained their maximum abundance in April, with a water-temperature of 17·8° C. In August (temp. 10° C.) they disappear with remarkable abruptness, the collections for this month containing thousands of the dead and decaying remains of these plants. Very few individuals persisted until the end of August, and in September, which is the last month of the cold period, Chlorophyceæ of all kinds were entirely absent. In October a few Desmids are again noticeable, and during the rise of temperature through November and December vast numbers of the smaller species make their appearance, amongst which should be specially mentioned *Euastrum Turneri* forma *minor*, *Cosmarium Capitulum* var. *australe*, *C. quadratulum*, *C. pygmæum*, *C. angulosum*, *Staurastrum bibrachiatum* var. *cymatium*, *S. tetracerum*, and a form of *S. excavatum*. Although the number of species (67) of Desmids present in the early part of the warm season, from November to December, is almost as great as the number (81) occurring during the autumn, from May to July, they do not give such a pronounced character to the collections. This is entirely due to the dominance of smaller and more inconspicuous species during the vernal period, as compared with larger and more ostentatious species which predominate in the autumnal period.

In November, and also to a less extent in December, the Zygnemaceæ and Oedogoniaceæ are dominant, and almost all in the fruiting condition. *The commencement of the fructiferous state simultaneously with a rising temperature is strictly comparable with what occurs in the southern and south-western counties of England.* I have observed repeatedly in Surrey and Hampshire, and more especially has it been brought to my notice in Devonshire and Cornwall, that the normal period of fructification in the Zygnemaceæ and the Oedogoniaceæ begins at or towards the end of April, and continues through May into June. With regard to thirteen species of the genus *Spirogyra*, Fritsch & Rich * have recently brought forward observations to show that zygospore-formation normally takes place during the vernal phase of their life-history.

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* F. E. Fritsch & F. Rich in Ann. Bot. xxi. (July 1907) pp. 432 & 436.

Five species of *Mougeotia* were observed with spores, one, *M. viridis*, in October, and the other four in November. This is again strictly comparable with the conditions under which fruiting takes place in the British Islands. Especially interesting is the first production of spores by *Mougeotia viridis*. In the British Islands this is almost invariably the first species of the genus to enter into the fructiferous condition in the spring. It begins its spore-formation in the Midlands and the Southern countries in March, with a water-temperature of 5°–7° C.; and in the more mountainous areas of the Pennine Chain, the English Lake District, and North Wales, fructification commences in April or May according to the state of the weather.

Fig. 5.

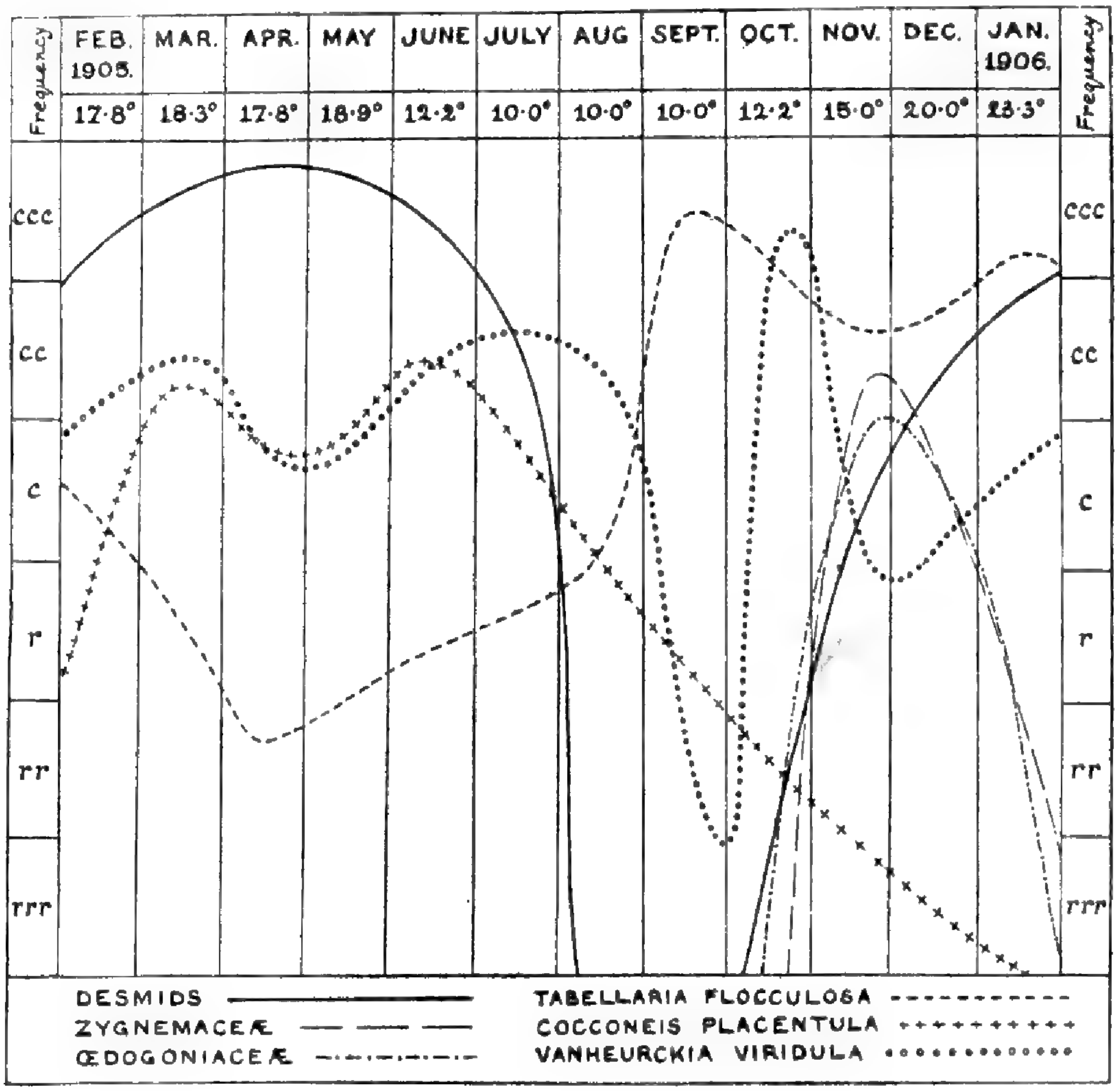

Chart showing the periodicity of some of the more important Chlorophyceæ and Diatoms of the Yan Yean littoral region.

It must be distinctly understood that this period of spore-formation is not necessarily the period of maximum vegetative growth of the species, which varies much according to conditions of environment. In the upland

and subalpine lakes and tarns of the British Islands, in which species of *Mougeotia* and *Zygnema* abound, the maximum vegetative abundance usually occurs in the late summer and early autumn as the temperature is gradually declining*. In these habitats spores are only rarely produced, the winter season being passed in the form of "cysts" †.

Only two species of the numerous Desmids of these weedy shores were observed with zygospores, namely, *Cosmarium contractum* var. *ellipsoideum* in March, and *Cylindrocystis diplospora* in April. I do not think this is at all remarkable, notwithstanding the abundance of Desmids in the littoral region of the Yan Yean, and it is entirely in accordance with numerous observations I have made in the British Islands. The occurrence of zygospores in the Desmidiaceæ appears to be very spasmodic, and the conditions which result in their production are apparently both local and special. I have collected and examined, during an extended study of the group, large numbers of the zygospores of Desmids, and have kept a careful record of all the species which have come under my notice in a fruiting condition. Only two points are manifest on a study of these records: first, that zygospores are not produced in the colder period of the year; and secondly, that they are more frequently formed in small pools, ponds, and ditches than in large bodies of water such as lakes. This is doubtless owing to the greater ease with which the necessary conditions may be attained in the smaller bodies of water. In no single instance have I known of the formation of Desmid-zygospores owing to impending drying-up of the pools, because, as a rule, Desmids only occur in permanent pools which are scarcely liable to be dried up. Many Desmids produce zygospores in spring, with a rising temperature, and many (perhaps the majority) in the late summer just after the maximum temperature. Zygospore-formation can be observed in stagnant pools and ditches in which there is practically no aëration of the water; it can also take place at the margins of lakes or in ditches with slowly flowing water, in which the aëration of the water is fairly good; and it also occurs on dripping rocks in which the conditions of aëration are at their maximum. Sometimes a species produces zygospores in abundance in one *Sphagnum*-pool, but in another adjacent pool, in which the same species is equally abundant, no zygospores are formed, although the individuals are apparently under precisely the same conditions. On the whole, we are at present almost entirely in the dark concerning the physiological conditions which result in zygospore-formation in the Desmidiaceæ. The precise conditions are probably widely different for various species of Desmids, owing to the great differences in the normal habitats of these plants.

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* In the littoral Alga-flora of the alpine lakes of the Pike's Peak region, Colorado, species of *Zygnema* and *Mougeotia* reach their maximum abundance in September, when the temperature is falling. *Cf.* Shantz, in Trans. Amer. Micr. Soc. xxvii. (March 1907) pp. 92 & 93.

† G. S. West, Treatise Brit. Freshw. Alg. (1904) pp. 115 & 121. The survival through the winter of many species of the Zygnemaceæ (but especially species of *Mougeotia*) by means of these resting "cysts" is much commoner than is imagined, and it occurs in lowland areas almost to the same extent as it does in the upland districts. I have found it to occur commonly in the English Midlands in ditches and *Sphagnum*-pools which I have had under continuous monthly observation for two years. Similar "cysts" occur frequently in *Ulothrix* and in *Rhizoclonium*. Each "cyst" consists of one or several vegetative cells which have entered into a period of quiescence or inactivity, after having developed rather thicker cell-walls. Sometimes a gelatinous envelope is also evident.

Species of the Protococcoideæ never appear to become a dominant feature of the benthos, and few of them can even be regarded as common. Some species are represented all through the year except in September and October, and the greatest variety of forms occurs in December and January.

Bacillarieæ.—*Melosira granulata* is common in March, but is otherwise scarce. *Tabellaria flocculosa* is very common in September, at a time when all other Algæ (including Diatoms) are exceedingly scarce. This species maintains its abundance until January, thus having its maximum period during the vernal rise of temperature (10°–23·3° C.). On the other hand, *Cocconeis Placentula* (free-floating and unattached) is very common from March to July, after which it gradually decreases in abundance. This species therefore attains its maximum during the autumnal fall of temperature (18·3°–10° C.). *Vanheurckia viridula* is one of the most conspicuous Diatoms of the Yan Yean benthos, being common nearly all the year round. It has a minimum period towards the end of September, which is followed very rapidly by a great maximum in October. For the complete annual periodicity of these Diatoms consult the chart (text-fig. 5, p. 33).

Myxophyceæ.—As in the plankton there are very few Blue-green Algæ in the benthos. One species of *Anabæna* occurred from March to July, being most abundant in April and May, but in 1905 it produced no spores. *Oscillatoria Agardhii* was common in July, but did not occur in any other month.

III. THE ALGÆ OF THE YAN YEAN DRAINAGE AREA.

POOLS IN THE YAN YEAN CATCHMENT BASIN.

Two pools were examined. The first one was a shallow grassy pool from which collections were made in October, 1905. The material consisted of Chlorophyceæ and Diatoms, and three species occurred in quantity. These were *Rhizoclonium hieroglyphicum*, Kütz., *Ulothrix subtilis*, Kütz., and *Spirogyra porticalis*, (Vauch.) Cleve, the latter in the fruiting condition. Among these three dominant species the following were observed :—

Chlorophyceæ.—*Bulbochæte* sp. (sterile), *Oedogonium pisanum*, Wittr. (in the fruiting condition), *O. victoriense*, G. S. West (in the fruiting condition), *Pleurotænium Ehrenbergii*, (Bréb.) De Bary (several forms), *P. truncatum*, (Bréb.) Näg., *Euastrum Turnerii*, West, *Cosmarium tinctum*, Ralfs, *C. granatum*, Bréb., *Staurastrum hexacerum*, (Ehrenb.) Wittr., *S. asperum*, Bréb. (small form), *Hyalotheca dissiliens*, (W. Sm.) Bréb., and *Eremosphæra viridis*, De Bary.

Bacillarieæ.—*Eunotia pectinalis*, (Dillw.) Rabenh., *E. major*, (W. Sm.) Rabenh. var. *bidens*, (Greg.) Van Heurck, *E. lunaris*, (Ehrenb.) Grun., *Cocconeis Placentula*, Ehrenb., *Navicula viridis*, Kütz., *Gomphonema intricatum*, Kütz., *Nitzschia Palea*, (Kütz.) W. Sm., *N. sigmoidea*, (Ehrenb.) W. Sm., *Hantzschia Amphioxys*, (Ehrenb.) Grun.

The collections from the second pool were all made in September, 1907, and consisted almost entirely of Chlorophyceæ. The dominating species were all Desmids, some of them being present in quantity. Diatoms were entirely absent. The following species were observed :—

Chlorophyceæ.—Sterile spp. of *Bulbochæte* and *Oedogonium*, *Coleochæte scutata*, Bréb. (with oogonia and antheridia), *Mougeotia* sp. (sterile), *Radiofilum conjunctivum*, Schmidle, *Closterium Cornu*, Ehrenb., *C. setaceum*, Ehrenb., *Triploceras gracile*, Bail. (very abundant ; several varieties), *Euastrum Turnerii*, West, forma, *E. denticulatum*, (Kirchn.) F. Gay, *Cosmarium Regnesi*, Reinsch, *C. impressulum*, Elfv., *C. venustum*, (Bréb.) Arch., var. *induratum*, Nordst., *C. quadratulum*, (F. Gay) De Toni, *C. pygmæum*, Arch., *C. pseudoprotuberans*, Kirchn., *C. contractum*, Kirchn., var. *ellipsoideum*, (Elfv.) W. & G. S. West, *C. amplum*, Nordst. (very abundant), *Staurastrum dejectum*, Bréb., *S. alternans*, Bréb., *S. cyrtocerum*, Bréb., *S. neglectum*, sp. n., *S. excavatum*, W. & G. S. West, *S. tetracerum*, Ralfs, *S. longiradiatum*, W. & G. S. West, *S. zonatum*, Börges., *S. sagittarium*, Nordst., *S. sexangulare*, (Buln.) Rabenh. (abundant), *Desmidium Baileyi*, (Ralfs) Nordst., *Sphærozosma Aubertianum*, West, *Spondylosium papillosum*, W. & G. S. West, *Hyalotheca dissiliens*, (W. Sm.) Bréb., *Characium longipes*, Rabenh., *Tetraëdron minimum*, (A. Br.) Hansg., *T. gigas*, (Wittr.) Hansg. (diam. 72–78 μ), *Ankistrodesmus falcatus*, (Corda) Ralfs, var. *acicularis*, (A. Br.) G. S. West, *Kirchneriella obesa*, W. & G. S. West, and *Glœocystis gigas*, (Kütz.) Lagerh.

Myxophyceæ.—*Merismopedia glauca*, (Ehrenb.) Näg.

Peridinieæ.—*Peridinium inconspicuum*, Lemm.

Small pools, Honeysuckle Flat.

These were a series of small "saucer-holes" only a few feet across and very shallow. The water becomes warmed up almost to a tepid condition in the sun, and the pools dry up in the warmest weather. The collections were made in September 1907, and contained the following species :—

Chlorophyceæ.—*Ulothrix idiospora*, sp. n. (with a seriate development of akinetes), *Zygnema leiospermum*, De Bary (in small quantity but in a fructiferous state).

Heterokontæ.—*Tribonema bombycina*, (Ag.) Derb. & Sol., forma *minor*, (Wille) G. S. West, *Ophiocytium majus*, Näg.

Bacillarieæ.—*Eunotia lunaris*, (Ehrenb.) Grun., *Navicula bicapitata*, Lagerst., *Gomphonema gracile*, Ehrenb., *Nitzschia Sigma*, (Kütz.) W. Sm.

Myxophyceæ.—*Oscillatoria Agardhii*, Gom.

All the above species, except those belonging to the Heterokontæ, have been derived from the Yan Yean Reservoir by the overflow of the waters during times of heavy rain. Species of the genus *Ophiocytium* thrive in pools which become stagnant and foul in hot weather. They appear to flourish best where there is little aëration of the water *. The dominant species of the pools were *Ulothrix idiospora* and the small form of *Tribonema bombycina*.

SMALL POOLS IN RANA CREEK.

The collections were made in September 1907, and the dominating Algæ were *Zygnema* sp. (sterile ; filaments very thick) and *Chætophora elegans*, (Roth) Ag. The others noticed were *Volvox globator*, (L.) Ehrenb., *Characium tenue*, Herm., *Navicula bicapitata*, Lagerst., *N. radiosa*, Kütz., var. *acuta*, (W. Sm.) Van Heurck, *Gomphonema gracile*, Ehrenb., and its var. *dichotomum*, (Kütz.) Van Heurck, *Nitzschia Palea*, (Kütz.) W. Sm., and *Chamæsiphon confervicola*, A. Br. The latter was attached thickly to the leaves of *Myriophyllum*.

POOLS IN OTTELIA CREEK.

Two pools of very different character were examined in September 1907. The first one was a stagnant pool dominated by *Tribonema bombycina*, (Ag.) Derb. & Sol., forma *minor*, *Ophiocytium parvulum*, (Perty) A. Br., *O. capitatum*, Wolle, and *Microthamnion Kützingianum*, Näg. The two species of *Ophiocytium* are well-known inhabitants of small stagnant pools; *Tribonema bombycina* f. *minor* thrives best in water which is fairly well aërated, but also often occurs in stagnant pools ; *Microthamnion Kützingianum* generally occurs in small pools, not necessarily stagnant, and it is a decided vernal type. In the British Islands it is seen at its best in April and May. Among the species mentioned were small quantities of the following :—

Chlorophyceæ.—*Oedogonium* sp. (with developing oogonia), *Oe. cryptoporum*, Wittr., *Zygnema* sp. (sterile), *Spirogyra quadrata*, (Hass.) Petit (in the fruiting condition), *Closterium Venus*, Kütz., *Pleurotænium truncatum*, (Bréb.) Näg., *Cœlastrum sphæricum*, Näg., *Ankistrodesmus falcatus*, (Corda) Ralfs.

Bacillarieæ.—*Eunotia lunaris*, (Ehrenb.) Grun., *Navicula bicapitata*,

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* Consult also F. E. Fritsch in Ann. Bot. xxi. (1907) pp. 256 & 257 ; Fritsch gives a summary of the records of *Ophiocytium* (up to 1906) in tropical pools.

Lagerst., *Navicula gibba*, (Ehrenb.) Kütz., *N. major*, Kütz., *N. appendiculata*, (Ag.) Kütz., *N. Iridis*, Ehrenb., var. *affinis*, (Ehrenb.) Van Heurck, *Gomphonema gracile*, Ehrenb., *G. tenellum*, Kütz., *Nitzschia Palea*, (Kütz.) W. Sm.

The second pool was not stagnant, and really formed a part of the boggy or marshy stream which drains Ottelia Creek into the Yan Yean Reservoir. The Algæ were mostly Chlorophyceæ and largely Desmids. The following species were observed :—

Chlorophyceæ.—*Oedogonium undulatum*, (Bréb.) A. Br. (sterile), *Coleochæte irregularis*, Pringsh., *Ulothrix idiospora*, sp. n., *Radiofilum conjunctivum*, Schmidle, *Triploceras gracile*, Bail., var. *robustum* var. n., *Euastrum ansatum*, Ralfs, *E. Turneri*, West, *Cosmarium obsoletum*, (Hantzsch) Reinsch, var. *sitvense*, Gutw., *C. granatum*, Bréb., *C. pseudoprotuberans*, Kirchn., *C. bireme*, Nordst., *C. Regnesi*, Reinsch, *C. quadratulum*, (F. Gay) De Toni, *C. venustum*, (Bréb.) Arch., var. *induratum*, Nordst., *C. impressulum*, Elfv., forma *suborthogona* (Racib.) nob. (= *C. suborthogonum*, Racib.), *C. sphalerostichum*, Nordst., *C. Blyttii*, Wille, *C. amœnum*, Bréb., var. *mediolæve*, Nordst., *Staurastrum Hardyi*, sp. n., *S. orbiculare*, Ralfs, var. *depressum*, Roy & Biss., *S. dilatatum*, Ehrenb., var. *obtusilobum*, De Not., *S. striolatum*, (Näg.) Arch. (with zygospores), *Onychonema filiforme*, (Ehrenb.) Roy & Biss., *Pediastrum Tetras*, (Ehrenb.) Ralfs, *Scenedesmus acutiformis*, Schröder, *Dictyosphærium pulchellum*, Wood, *Glœocystis gigas*, (Kütz) Lagerh., var. *maxima*, West.

Bacillarieæ.—*Tabellaria flocculosa*, (Roth) Kütz., *Synedra Ulna*, (Nitzsch) Ehrenb., *Navicula major*, Kütz., *N. radiosa*, Kütz., *Vanheurckia rhomboides*, (Ehrenb.) Bréb., *Cocconema gracile*, (Rabenh.) G. S. West.

Myxophyceæ.—*Anabæna* sp. (sterile).

TOOROURONG RESERVOIR.

I. *Plankton*.—This was collected by boat on July 25th, 1907, along a course clear of weeds. The material contained large quantities of decaying organic matter and fine sand, mixed chiefly with Diatoms, and is of particular interest in comparison with the plankton of the Yan Yean. *Ceratium Hirundinella* was not uncommon although quite absent from the Yan Yean, and a beautiful new variety (var. *pulcherrima*) of *Micrasterias Thomasiana* was also frequent. The most interesting Diatom was *Gyrosigma distortum* var. *Parkeri*, and the frustules of *Vanheurckia rhomboides* reached a large size (135 μ in length). The following were the species observed :—

Chlorophyceæ.—Fragments of *Oedogonium* sp. and *Microspora* sp., *Closterium Venus*, Kütz., *Micrasterias Thomasiana*, Arch., var. *pulcherrima* var. n.

Bacillarieæ.—*Tabellaria flocculosa*, (Roth) Kütz., *Synedra Ulna*, (Nitzsch) Ehrenb., *Fragilaria crotonensis*, (A. M.-Edw.) Kitton, *Eunotia pectinalis*, (Dillw.) Rabenh., *E. crispula*, sp. n., *Navicula cardinalis*, Ehrenb., *N. gracilis*, Kütz., *N. gibba*, (Ehrenb.) Kütz., *N. viridis*, Kütz., *N. Brébissonii*, Kütz., *N. rhynchocephala*, Kütz., *Vanheurckia rhomboides*, (Ehrenb.) Bréb., *Gyrosigma distortum*, W. Sm., var. *Parkeri*, (Harris.) Cleve, *Gomphonema gracile*, Ehrenb., *Cocconema cuspidatum*, (Kütz.) G. S. West, *Surirella robusta*, Ehrenb., var. *splendida*, (Ehrenb.) Van Heurck, *S. biseriata*, Bréb., *S. linearis*, W. Sm.

Myxophyceæ.—*Oscillatoria* sp. (fragmentary; probably *O. Agardhii*, Gom.).

Peridinieæ.—*Ceratium Hirundinella*, O. F. Müll. The forms were slightly different from any others I have seen. The second antapical horn was almost as long as the first one, and the third was of good length and curved inwards. (Pl. **2**. fig. 15.)

II. *Littoral Algæ.*—The weeds at the margins of the reservoir were mostly *Eleocharis sphacelata*, R. Br., and a species of rush. Like the plankton the weed-collections were almost entirely Diatomaceous. The greater part of the material consisted of immense quantities of *Tabellaria flocculosa* and *Navicula gracilis*, amongst which the following species were observed rather sparingly :—

Chlorophyceæ.—Sterile species of *Oedogonium*, *Mougeotia*, and *Zygnema*, *Closterium Venus*, Kütz., *Cosmarium angulosum*, Bréb., *C. Regnellii*, Wille, *C. impressulum*, Elfv., forma *suborthogona*, (Racib.) nob., *Staurastrum pygmæum*, Bréb.

Bacillarieæ.—*Synedra Ulna*, (Nitzsch) Ehrenb., *S. Acus*, (Kütz.) Grun., *Achnanthes linearis*, W. Sm., *Navicula major*, Kütz., *N. gibba*, (Ehrenb.) Kütz., *N. Iridis*, Ehrenb., *N. dicephala*, Ehrenb., *N. exilis*, (Kütz.), Grun., *Gomphonema gracile*, Ehrenb., *Cocconema gracile*, (Rabenh.) G. S. West, *Nitzschia Palea*, (Kütz.) W. Sm.

Wallaby Creek Weir.

Plankton collections were obtained from the outlet by allowing the outflowing current to pass through the net for about twenty minutes at a time. The material contained a vast amount of organic matter and a quantity of fine sand. No predominating species were noticeable, but the following were observed :—

Chlorophyceæ.—Sterile species of *Oedogonium*, *Mougeotia*, *Zygnema*, and *Spirogyra*, *Closterium prælongum*, Bréb., forma *brevior*, West, *C. Ulna*, Focke (very elongated form; long. 675 μ, lat. 20 μ), *Penium margaritaceum*, Ehrenb., var. *irregularius*, W. & G. S. West, *Cosmarium trachypleurum*, Lund., var. *subglabrum* var. n., *Tetraspora lacustris*, Lemm.

Heterokontæ.—*Tribonema bombycina*, (Ag.) Derb. & Sol., forma *minor*.

Bacillarieæ.—*Tabellaria flocculosa*, (Roth) Kütz., *Synedra Ulna*, (Nitzsch) Ehrenb., *Navicula radiosa*. Kütz., *Vanheurckia rhomboides*, (Ehrenb.) Bréb., *V. viridula*, Bréb., *Gomphonema gracile*, Ehrenb., *Surirella linearis*, W. Sm.

Myxophyceæ.—*Oscillatoria irrigua*, Kütz.

A small collection from amongst wet mosses on the Wallaby watershed yielded the following:—*Mougeotia* sp., *Netrium Digitus*, (Ehrenb.) Itzigs. & Rothe, *Navicula viridis*, Kütz., *N. bicapitata*, Lagerst., *Vanheurckia rhomboides*, (Ehrenb.) Bréb., *V. viridula*, Bréb., *Achnanthes coarctata*, Bréb., *Surirella linearis*, W. Sm.

SILVER CREEK WEIR.

Samples of plankton were obtained both from the outlet and from alongside the stone embankment of the dam. As in the case of the material collected from Wallaby Creek Weir, an enormous amount of decaying organic matter was present, amongst which were numerous sporangia of ferns and fragments of Bryophytes. The dominant algal constituent was *Synedra Ulna*, and the following were also present in smaller quantity:—

Chlorophyceæ.—*Closterium prælongum*, Bréb., forma *brevior*, West.

Bacillarieæ.—*Melosira granulata*, Ralfs, *Eunotia major*, (W. Sm.) Rabenh., var. *bidens*, (Greg.) Van Heurck, *Tabellaria flocculosa*, (Roth) Kütz., *Navicula Brébissonii*, Kütz., *Vanheurckia rhomboides*, (Ehrenb.) Bréb., *V. vulgaris*, (Thw.) Van Heurck, *Surirella robusta*, Ehrenb., var. *splendida*, (Ehrenb.) Van Heurck, *S. linearis*, W. Sm.

Myxophyceæ.—*Oscillatoria irrigua*, Kütz.

In the channel above the weir, *Tribonema bombycinum* forma *minor* occurred in quantity along with *Synedra Ulna*.

The Wallaby and Silver Creek collections were made in July, 1907.

IV. THE RELATIONS BETWEEN THE PLANKTON, BENTHOS, AND ALGÆ OF THE DRAINAGE AREA.

The phytoplankton of the Yan Yean Reservoir, in the thirteen months from Feb. 1905 to Feb. 1906, contained 104 species and 16 varieties. During the same period 206 species and 17 varieties were observed in the microphytic benthos. Of these Algæ, 79 *species and* 6 *varieties were common to both plankton and benthos*, and 23 *species and* 5 *varieties were exclusively confined to the plankton*. Of the latter, the following species and varieties are *true plankton-forms*:—

Closterium Kützingii, *Cosmarium tortum* forma *trigona*, *Staurastrum muticum* var. *victoriense*, *S. lævispinum* var. *subbrachiatum*, *S. patens* var. *planctonicum*, *S. paradoxum* var. *longipes*, *Pediastrum duplex* var. *clathratum*, *Closteriopsis longissima*, *Kirchneriella lunaris*, *Oocystis lacustris*, *O. parva*, *Lagerheimia splendens*, *Botryococcus Braunii*, *Melosira granulata* var. *spinosa*, *Rhizosolenia morsa*, *Gyrosigma elongatum* var., *Chroococcus limneticus* var. *subsalsus*, and *Dinobryon elongatum* var. *undulatum*.

Some species, although present in both the plankton and the benthos, are so much more abundant in the former that they also must be regarded as true plankton-forms. Such are:—*Pleurotænium mamillatum, Micrasterias Hardyi, Cosmarium Hardyi, Staurastrum mucronatum* var. *delicatulum, Melosira granulata, Peridinium Volzii* var. *australe, Dinobryon cylindricum* and its var. *divergens.* To these may be added *Staurastrum longiradiatum, Volvox aureus,* and *Eudorina elegans.*

A few species, such as *Cosmarium perfissum, C. achondroides, C. contractum* and its var. *ellipsoideum,* are equally common in both plankton and benthos, thriving both in the comparative shelter of the weedy margins and in the more disturbed limnetic region of the lake. *Staurastrum victoriense* was present in small quantity in the plankton all the year round, but in the littoral region it only occurred from April to July, reaching a maximum in the latter month and disappearing immediately afterwards.

Quite a number of species occur in the drainage area, and even in the catchment basin, which have not been found either in the plankton or the littoral region of the Yan Yean. In the case of certain species this is rather remarkable, as they occur in quantity in small pools within a few yards of the reservoir yet not in any part of the lake itself. Of these species, *Radiofilum conjunctivum, Pleurotænium truncatum, Cosmarium amplum,* and *Staurastrum zonatum* are the most noteworthy, and they afford a direct contrast to the 23 species exclusively confined to the plankton.

In comparison with the phytoplankton of the Yan Yean Reservoir, that of the Toorourong Reservoir and of the Wallaby and Silver Creek Weirs is almost insignificant. Compared with the 104 species constituting the phytoplankton of the Yan Yean, 24 occurred in the Toorourong, 18 in Wallaby Creek Weir, and only 11 in Silver Creek Weir. Most of the plankton of these upper dams consists of decaying organic matter and fine sand, and the meagreness of the phytoplankton is due to the constant agitation and continual renewal of the water *. Most of the constituents are Diatoms, and the number of species gradually decreases as the disturbance of the water becomes greater owing to the diminished size of the reservoirs. The few species of Chlorophyceæ were principally Desmids, but they were of quite a distinct character from those found in the Yan Yean. The most noticeable feature among the Diatoms was the large size attained by the frustules of *Vanheurckia rhomboides.*

The algal investigation of the upper dams shows clearly that the Yan Yean Reservoir does not receive any of its characteristic algal constituents from these sources, even though six-sevenths of its total water-supply comes along the aqueduct from the Toorourong, having been derived from the large drainage area tapped by these upper reservoirs. We have, therefore, to turn next to the Yan Yean catchment basin for information concerning the source of the rich and varied assortment of Algæ constituting the phytoplankton and microphytic benthos of the Yan Yean. It is along the boggy inlets of Rana and Ottelia Creeks that one finds a rich Alga-flora such as would be able to furnish the microphytic benthos, and also the plankton, with some of their characteristic species. It seems highly probable that many of the species of the littoral region are recruited by means of individuals carried into the lake with the slow drainage from these two boggy creeks, and that in turn the plankton receives recruits of certain of these species from the littoral region.

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* *Cf.* also H. L. Shantz, "Prelim. Report on the Biol. Study of the Lakes of the Pike's Peak Region," Trans. Amer. Micr. Soc., March 1907, p. 91.

Some of the species common to both the plankton and the benthos reach their maximum development in the plankton (Feb.–April) some time before they attain their maximum abundance (May–June) in the benthos. In this respect, *Cosmarium contractum* (and its var. *ellipsoideum*), *Staurastrum corniculatum* (and its var. *spinigerum*), *S. muticum*, *S. leptacanthum*, and *Oscillatoria Agardhii* are particularly noticeable. These species after practically disappearing from the plankton, reappear in the littoral region, and under the new conditions attain a second maximum. Thus during the fall of temperature in the early autumnal period the microphytic benthos obtains some of its constituents from the plankton.

Turning now to a consideration of the phytoplankton, many of the species are without doubt derived from the microphytic benthos, and some of them thrive as well under limnetic conditions as they do among the weeds at the shores. The chief interest centres around the 23 species and 5 varieties exclusively confined to the plankton, and the few others which are so much more abundant in the limnetic region than elsewhere. Whence did they originate? Some of them have most probably been derived from the littoral region, and finding the conditions of plankton-existence eminently suitable, have thrived to an unprecedented degree. Some have in consequence become dominant features of the plankton throughout the greater part of the year, whereas either they cannot be detected at all in the littoral region, or the most diligent search fails to reveal more than very few isolated individuals. *Micrasterias Hardyi* is a case in point. This Desmid is the rarest of casuals among the weeds of the littoral region, but it is the most conspicuous and dominating species of the phytoplankton throughout the entire year. It most likely had an origin from a littoral or even from a bog-species, and the great development of its outstanding lobes at once distinguishes it from any of its bog or swamp relatives. This feature has most certainly been developed as a result of adaptation to a limnetic existence, as the outstanding lobes materially increase the floating capacity of the individual. The occurrence of *Micrasterias Hardyi* in the benthos is merely accidental, and the only clue to the original species from which it has been derived is such as is furnished by its morphological peculiarities. These point most decidedly to some form of *Micrasterias mahabuleshwarensis* as being the ancestor of *Micrasterias Hardyi*, and this is further confirmed by the occurrence of *M. mahabuleshwarensis* in the bogs and swamps of several parts of Victoria.

With regard to species such as *Rhizosolenia morsa*, *Lagerheimia splendens*, and others, there is no definite information as to how they have obtained a footing in the plankton. Much more investigation is yet required concerning the formation of resting-spores in these Algæ, the resistance of such spores to desiccation, and the possibilities of transport by means of water-fowl such as abound on the Yan Yean Reservoir.

V. SYSTEMATIC ACCOUNT OF THE MORE NOTEWORTHY SPECIES.

The first systematic account of importance dealing with the freshwater Algæ of the Australasian region was by Nordstedt in 1888[1]. In this work the author described and figured with great care a number of Algæ (especially Desmids) which are more or less peculiar to this region of the earth. Very few of the species were Australian, the great majority being from New Zealand, the Alga-flora of which country had already been partially investigated by Spencer[2] and also by Maskell[3].

Other contributions to the Alga-flora of Australia have since appeared by Raciborski[4], Moebius[5], Schmidle[6], and Borge[7]; and three papers have recently been published in the 'Victorian Naturalist' by Mr. Hardy[8], enumerating a variety of Algæ from parts of Southern Victoria. In the latter papers, at Mr. Hardy's request, I described the new forms, and descriptions of some of them have also appeared in the 'Journal of Botany'[9].

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[1] O. Nordstedt, "Fresh-water Algæ collected by Dr. S. Berggren in New Zealand and Australia." Kongl. Sv. Vet.-Akad. Handl. xxii. no. 8 (1888).

[2] W. J. Spencer, "Notes on Fresh-water Algæ." Trans. and Proc. N. Zeal. Instit. xv. (1883).

[3] W. M. Maskell, "On the New Zealand Desmidieæ." Trans. and Proc. N. Zeal. Instit. xv. (1883); also xviii. (1885). To these must be added Maskell's later paper, "Further Notes on the Desmidieæ of New Zealand," *l. c.* xxi. (1889).

[4] M. Raciborski, "Desmidyja zebrane przez Dr. E. Ciastonia etc." Rozpraw Wydz. matem.-przyr. Akad. Umiej. Krakow. xxii. (1892).

M. Moebius, "Australische Süsswasseralgen." Flora, Heft 3 (1892).

[6] W. Schmidle, "Süsswasseralgen aus Australien." Flora, Bd. 82, Heft 3 (1896).

[7] O. Borge, "Australische Süsswasserchlorophyceen." Bih. till K. Sv. Vet.-Akad. Handl. xxii. no. 9 (1896). Most of this work and some of the preceding works have been partly republished in F. M. Bailey's 'Contributions to the Queensland Flora,' xi. (1895), xv. (1898); unfortunately the defective figures of Cooke and of Wolle have been largely copied in these publications.

[8] A. D. Hardy, "The Fresh-water Algæ of Victoria," Victorian Naturalist, xxi. (1904); xxii. (1905); xxiii. (1906).

[9] G. S. West, "Desmids from Victoria." Journ. Bot., Sept. 1905.

The latest contribution to our knowledge of Australian Algæ is a paper by Playfair on Desmids from New South Wales [*]. This paper is unfortunately too reminiscent of W. B. Turner's "Fresh-water Algæ of East India" [†]. It affords a marked contrast to the careful work of Nordstedt, exhibiting a want of experience of the family dealt with [‡]. Especially is this the case in the suggestions for grouping well-marked types under one species and in the founding of other species on the most trivial characters. There is likewise an inexactitude in the figures which is but too common among the students of this group of Algæ. Judging by his continual references to "immature forms," Mr. Playfair seems to have rather curious ideas on the growth of Desmids. He appears to imagine that a Desmid may change its form, or develop spines or warts, at any time during its existence, losing sight of the fact that, unless dealing with monstrosities, *at least one semicell of any Desmid must be mature.* Cell-division, except under abnormal circumstances, does not take place until the two halves of a Desmid are equally developed, the newer half having arrived at maturity. Consequently, *in any Desmid in which the two semicells are exactly alike, growth has ceased, and that individual is mature* [§]. Further alteration of form, excluding the possibility of changes caused by the attacks of parasites, does not take place after the completion of the development of the new half, and spines once formed cannot become bifid or trifid, or in some other way change their nature, as Mr. Playfair appears to imagine. Neither do monstrosities appear to be particularly common in Australia. I have examined large numbers of Australian Desmids, and cell-division amongst this family appears to take place in Australia much as it does elsewhere, the new semicells arriving at maturity with but slight variation from the old ones.

The works which have just been cited, together with the present investigation, although dealing with very limited and somewhat remote parts of the Australian continent, yet enable one to form a general idea of the Alga-flora of Eastern Australia. They are also sufficient to show that among the more cosmopolitan forms there are a number of types peculiar to Australia and New Zealand. These are specially considered in a succeeding chapter.

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[*] G. J. Playfair, "Some new and little-known Desmids found in New South Wales." Proc. Linn. Soc. N. S. Wales, xxxii. part 1 (1907), pp. 160–200, t. 2–5.

[†] W. B. Turner in Kongl. Sv. Vet.-Akad. Handl. xxv. no. 5 (1893).

[‡] Mr. Playfair describes under the name of "*Closterium Cancer*, sp. n." either a species of the Protococcaceous genus *Reinschiella* or a resting-cyst of one of the Peridiniales; his description and figure are insufficient to determine the point. Under the name of "*Closterium naviculoideum*, sp. n." he appears to have described one of the common attenuated Diatoms of the genus *Nitzschia*, presumably *Nitzschia acicularis*. He also states that another species of *Closterium* ("*C. calamus*, sp. n.") possesses parietal chloroplasts, whereas his figure clearly shows the usual axile ridged chloroplasts of *Closterium* with a central row of pyrenoids.

[§] The only exceptions to this are those few species of *Closterium* and *Penium* which develop a "girdle-band." This is a cylindrical piece of cell-wall intercalated between the new and the old half-cells, and resulting from a growth to maturity subsequent to the completion of cell-division.

The present chapter deals only with those species observed in Mr. Hardy's collections which are deemed worthy of special mention, either because they have not previously been described, or because the Australian specimens have furnished new facts concerning them.

It is difficult to say which of the following 68 species should be regarded as the most interesting, but one could with justice include in such a selection *Ulothrix idiospora*, *Radiofilum conjunctivum*, *Debarya Hardyi*, *Micrasterias Hardyi*, *Staurastrum victoriense*, *Lagerheimia splendens*, *Rhizosolenia morsa*, *Gyrosigma elongatum*, and *Peridinium Volzii* var. *australe*.

Class **CHLOROPHYCEÆ.**

Order OEDOGONIALES.

Family **OEDOGONIACEÆ.**

Genus OEDOGONIUM, *Link.*

1. Oedogonium suecicum, *Wittr. in Botan. Notiser* (1872) p. 5; *Hirn, in Acta Soc. Scient. Fennicæ*, xxvii. (1900) p. 82, t. 2. fig. 15.

Forma australis. (Text-fig. 6, E.)

Forma cellulis vegetativis paullo crassioribus; echinis robustioribus et sparsioribus.

Crass. cell. veget.	14–16 μ;	altit.	4–5-plo major;
,, oogon.	40–41 μ;	,,	40–41 μ;
,, oospor. (sine echin.)	31–33 μ;	,,	31–33 μ.

Long. echin. 2·5–3 μ.

Hab. Yan Yean Reservoir, at the weedy margin (Nov. 1905).

2. Oedogonium oblongum, *Wittr. in Botan. Notiser* (1872) p. 2; *Hirn, l. c.* p. 185, t. 29. fig. 181.

Crass. cell. veget.	6·5–7·5 μ;	altit.	4–8-plo major;
,, oogon............	20–24 μ;	,,	46–60 μ;
,, oospor.	19–22 μ;	,,	34–36 μ.

Hab. Yan Yean Reservoir, among the weeds (in fruiting condition Nov. and Dec. 1905).

3. Oedogonium monile, *Berk. & Harv. in Hook. f. Flora Tasmaniæ*, ii. (1860) p. 342, t. 196. fig. B; *Hirn, l. c.* p. 229, t. 38 et 39. fig. 235.

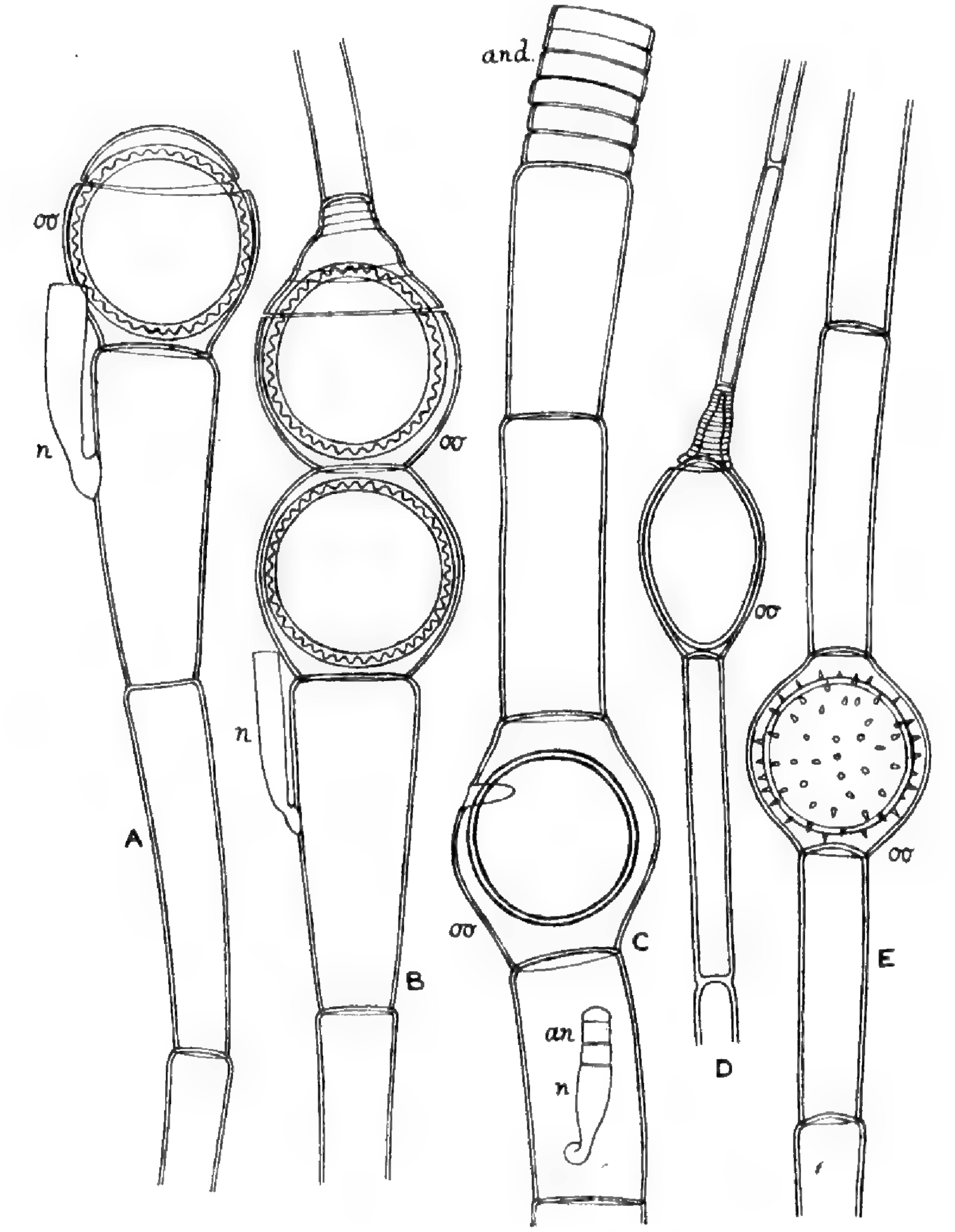
Forma victoriense. (Text-fig. 6, A & B.)

Forma paullo major; nannandribus elongatis et angustioribus, in cellulis suffultoriis sedentibus.

Crass. cell. veget.	12–44 μ;	altit. 5–7-plo major;
,, ,, suffult. ...	27–28 μ;	,, 2½–3-plo major;
,, oogon............	42–45 μ;	,, 42–52 μ;
,, oospor.	40–42 μ;	,, 40–42 μ;
,, stip. nannandr..	6·5– 8 μ;	,, 38–44 μ.

Hab. Yan Yean Reservoir, among the weeds (in fruiting condition in Dec. 1905).

Fig. 6.



A and B. *Oedogonium monile*, Berk. & Harv., forma *victoriense*, ×500; C. *O. victoriense*, G. S. West, ×470; D. *O. pisanum*, Wittr., ×520; E. *O. suecicum*, Wittr., forma *australe*, 500. *oo*, oogonia; *n*, nannandrium; *an*, antheridium; *and*, androsporangium.

The oogonia of the Australian form were solitary or binate, and not infrequently a single oogonium terminated the filament. Not only is typical *O. monile* known from Victoria, but three distinct forms of it are known to occur in Australia. The present form is distinguished from them all by the narrower and more elongated dwarf-males. It should be compared with forms of *O. Borisianum*, (Le Cl.) Wittr.

4. OEDOGONIUM VICTORIENSE, *G. S. West in Victorian Naturalist*, xxiii. (1906) p. 22.

Oe. dioicum, nannandrium, gynandrosporum ; oogoniis singulis, ellipsoideo-globosis vel ellipsoideo-doliiformibus, poro superiore apertis ; oosporis exacte globosis, oogonia non complentibus, episporio glabro ; androsporangiis 5–6-cellularibus ; nannandria in cellulis suffultis sita, stipite curvato, antheridiis internis bicellularibus ; cellulis suffultis levissime dilatatis. (Text-fig. 6, C.)

Crass. cell. veget.	25–29 μ ;	altit. 2–3-plo major ;
,, oogon.	49 μ ;	,, 57 μ ;
,, oospor.	39 μ ;	,, 39 μ ;
,, androsporang....	25–26 μ ;	,, 4·2–8 μ ;
,, cell. antherid....	7·5 μ ;	,, 4·8 μ.

Hab. In a shallow pool in the Yan Yean drainage area (Oct. 1905).

This species is perhaps nearest to *O. crassiusculum*, Wittr., but differs in its solitary oogonia and exactly globose oospores, the latter by no means filling up the former. The nannandria are also much more curved and the antheridia two-celled. From *O. macrandrium*, Wittr., it is distinguished by the greater thickness of its vegetative cells, by the solitary oogonia with a superior pore, and by the relatively smaller size of the oospore. It is also gynandrosporous, whereas *O. macrandrium* is not. *O. victoriense* should also be compared with *O. cataractum*, Wolle.

Order CHÆTOPHORALES.

Family **ULOTRICHACEÆ**.

Genus ULOTHRIX, *Kütz.*

5. ULOTHRIX IDIOSPORA, sp. n. (Pl. **2.** figs. 12–14.)

U. in cæspitibus parvis inter alias algas aquaticas reperta ; filis vegetativis subflexuosis, cellulis diametro $\frac{3}{4}$–$2\frac{1}{4}$-plo longioribus ; chromatophora parva parietali leviter lobata, cum pyrenoide singulo conspicuo ; sporis solitariis vel seriatim dispositis, ellipsoideis, doliformibus, vel elongatis et subcylindricis, diametro cell. veget. majoribus, membrana crassa, grosse et irregulariter scrobiculata.

Crass. cell. veget. 8–10 μ; long. spor. 18–36 μ; lat. spor. 10–13 μ.

Hab. Yan Yean Reservoir; sparingly among *Mougeotia victoriensis* and several species of *Oedogonium* at the weedy margins (Nov. 1905). Also more abundantly, mixed with *Tribonema bombycina*, in small, shallow pools in Honeysuckle Flat (Sept. 1907).

This species of *Ulothrix* is at once characterized by the peculiar nature of its spores. They arise, either singly or in chains of upwards of 20, from the ordinary vegetative cells. During the formation of a spore the vegetative cell increases to about twice its volume and becomes ellipsoid or doliform. The cell-wall increases much in thickness and possesses in the ripe spore numerous coarse scrobiculations. It is the scrobiculated character of the wall of these spores which distinguishes *U. idiospora* from all other described species of *Ulothrix*. The spores are resting-spores (hypnospores) and come under the heading of "akinetes," as they arise by the further growth of the original mother-cell, and not by the formation of an entirely new cell-wall within that of the mother-cell.

In the thickness of its vegetative filaments *U. idiospora* is very similar to *U. tenerrima*, Kütz. (*vide* Hazen in Bull. Torr. Bot. Club, xi. (1902) p. 151, t. 21. figs. 3–4), but the cells are generally proportionately longer. The akinetes of *U. tenerrima*, and indeed of all the allied species, are shorter and more angular than those of *U. idiospora*, with thinner, perfectly smooth walls.

Spores were rarely observed in the filaments from the weedy margins of the reservoir, but from the shallow pools in Honeysuckle Flat most of the filaments were in a state of spore-formation. Mr. Hardy writes that the water of these pools was warmed by the sun almost to a tepid condition, as they were only about four feet across and but a few inches deep, having been left by the receding of the water of the reservoir. Spore-formation seems thus to have been produced by the increase in temperature of the water and the incipient drying-up of the pools. The spores would remain in the mud on the pools becoming quite dry, germination taking place on the re-flooding of these hollows, which takes place when the water of the reservoir is very high.

Genus RADIOFILUM, *Schmidle.*

6. Radiofilum conjunctivum, *Schmidle, in Flora*, Bd. 78 (1894), p. 47, t. 7. figs. 4–5; *Chodat, "Algues Vertes de la Suisse," Beitr. Kryptogamenfl. Schweiz*, 1902, p. 271.—R. apiculatum, *W. & G. S. West, in Journ. Bot.* xxxiii. (1895) p. 52; *Bohlin, in Bih. till K. Sv. Vet.-Akad. Handl.* xxiii. (1897) p. 10, t. 1. figs. 6–8.

Lat. cell. 4·5–6 μ; long. cell. 5–8 μ. (Pl. **6**. figs. 1–3.)

Hab. Among weeds, Honeysuckle Flat, and in small pools, Ottelia Creek (Sept. 3, 1907).

This interesting member of the Ulotrichaceæ has been previously found in Germany, the United States, and Paraguay. The Australian forms agree with those described as *Radiofilum apiculatum* in the presence of a slight apiculus at each side of the cell, but the cells themselves are proportionately longer. *R. apiculatum* must now be regarded as identical with *R. conjunctivum,* since Schmidle has re-examined his specimens of the latter and found that he omitted some of the most salient characters from his original description—characters upon which the species *R. apiculatum* was founded (*vide* Schmidle, in Botan. Zeitschr. (1900) no 12).

The wall of each individual cell is composed of two halves, and cell-division appears to take place much as it does in some of the simpler types of Desmids, such as *Penium,* by the interpolation of two new half-cells between the old ones. The line of junction of the old and new halves of the wall is distinctly visible in most specimens, and is particularly obvious at the marginal apiculations, the latter owing their prominence to the projecting suture at this region. Each fully-grown half is helmet-shaped, but in its earliest stages the young half is much flattened. The chloroplasts are parietal and cup-shaped, occupying about two-thirds of the interior of the cell-wall. They are disposed very largely back to back in pairs of adjacent cells. The connections between the cells are not mucilaginous, but are caused by polar thickenings of the cell-wall. In the apical cell of a filament the terminal, free half of the cell is hemispherical.

One filament was observed which possessed a lateral branch (Pl. **6**. fig. 3), the basal cell of the branch being attached by a forked polar connection to two cells of the main filament. This branch most likely arose as a result of rapid cell-division, the middle cell of three sliding out laterally and developing a connection with each of the other two.

Möbius has described (in Abhandl. d. Senckenb. naturf. Ges. xviii. (1894) p. 320, t. 1. figs. 22–25) from Queensland an Alga which he placed as a variety of *Hormospora transversalis,* Bréb.; but it appears probable from his description of the cell-division, that the plants he observed should be relegated to the genus *Radiofilum.* In the two known species of the latter genus—*R. conjunctivum* (including *R. apiculatum*) and *R. flavescens*—no longitudinal division of the cells has been observed such as Möbius describes as occurring in his Queensland plants. Möbius considers that the genus *Hormospora* should have a place in the Tetrasporaceæ in proximity to *Palmodactylon*; but, so far as I can judge from a wide knowledge of all these genera, there is no doubt whatever that both *Hormospora* and *Radiofilum* are feebly developed members of the Ulotrichaceæ.

Order CONJUGATÆ.

Family **ZYGNEMACEÆ.**

Genus MOUGEOTIA, *Ag.*

7. **Mougeotia subcrassa**, sp. n. (Pl. **2.** figs. 4–5.)

M. crassa, cellulis vegetativis diametro 6–6½-plo longioribus, chromatophora magna et crassa cum pyrenoidibus subirregulariter dispositis numerosis (15–24); sporis ubi conjugatione scalariformi productis, globosis et subparvis, diametro cellularum veget. æqualibus; membrana sporæ glabra et indistincte lamellosa; cellulis conjugationibus fere rectis vel levissime curvatis.

Crass. cell. veg. 41·5–43 μ; diam. spor. 40–41 μ.

Hab. Yan Yean Reservoir; among the weeds (Oct. and Nov. 1905).

The best conjugated specimens of this species were observed in November. It is remarkable for the relatively small size of the spores as compared with the diameter of the vegetative cells, a character which distinguishes it from *M. scalaris*, Hass., and *M. crassa*, Wolle. It is also distinguished from the former by the much greater thickness of its vegetative cells and by the larger chloroplasts with more numerous pyrenoids; and from the latter by its slightly longer and thinner vegetative cells.

The spore-wall is thicker next the sterile cells than at its exposed parts, as in these regions the partition-walls which cut off the fertile cell (spore) from the two sterile cells are fused with the more newly-formed wall of the spore. It was this manifest partition of the conjugated structure into fertile and sterile cells, *before the formation of any actual spore-walls*, which induced Wittrock to regard this part of the life-history of *Mougeotia* as a rudimentary sporophyte.

8. **Mougeotia recurva**, (*Hass.*) *De Toni.*—Mesocarpus recurvus, *Hass. Brit. Freshw. Alg.* 1845, t. 43. fig. 2.

Crass. cell. veget. 12–14 μ; diam. spor. 25–28 μ.

Hab. Yan Yean Reservoir; among weeds (Nov. 1905).

I am in considerable doubt about this determination. Only a few specimens were observed, and they differed in the proportionately longer vegetative cells and in the straightness of the conjugating cells. The plants observed were probably abnormal states, as *some of the filaments had produced both globular and cylindrical aplanospores*, the former (diam. 24 μ) at the outer angles of geniculate cells (*vide* Wittrock, in Bih. till Sv. Vet.-Akad. Handl. i. (1872) t. 2. figs. 7, 8), and the latter (long. 34 μ; lat. 14 μ) in the middle of straight cells.

9. Mougeotia victoriensis, sp. n. (Pl. **2.** fig. 1.)

M. subparva, cellulis vegetativis diametro $9\frac{1}{2}$–14-plo longioribus, chromatophora elongata cum pyrenoidibus 2–7 (plerumque 5–6) in serie singula subirregulariter ordinatis; cellulis conjugatis elegante genuflexis; sporis globosis; intra cellulas steriles parte inclusis, membrana glabra; circa sporam unamquemque et partes propinquas cellulæ sterilium cum tegumento mucoso amplo sphærico.

Crass. cell. veget. 11·5–12 μ; diam. spor. 21–24 μ; diam. integ. mucos. 60–63 μ.

Hab. Yan Yean Reservoir; at the weedy margins (Nov. 1905).

M. victoriensis is undoubtedly nearest to *M. parvula*, Hass., but is distinguished by its slightly thicker vegetative cells, which are also somewhat more elongate, and by the large gelatinous envelope surrounding the spores. One other species of this genus is known with a wide gelatinous coat enveloping the spores, namely, *M. gelatinosa*, Wittr. (in Wittr. & Nordst. Alg. Exsic. (1889) no. 957, fasc. 21, pp. 26, 27 cum fig.). This species, which I have examined from both England and Scotland, differs much from the Australian plant in the thickness of its vegetative cells and in the form of its spores. Moreover, the mucous coat of the spore is usually interpolated between the spore-wall and the adjacent parts of the conjugating-tube, whereas in *M. victoriensis* the mucous coat envelops not only the spore but also the adjacent parts of the gametangia (the sterile cells of Wittrock). The conjugating-tube of *M. victoriensis* is relatively much wider than that of *M. parvula* or *M. gelatinosa*, and the spores are partially immersed in the gametangia.

The gelatinous coat surrounding the spore of *M. victoriensis* is almost three times the diameter of the spore itself, and is commonly encrusted with minute particles of mineral and organic detritus.

Genus DEBARYA, *Wittr.*

10. Debarya Hardyi, sp. n. (Pl. **2.** figs. 6–11.)

D. inter alias Conjugatas intermixta; cellulis vegetativis 9–16-plo longioribus, pyrenoidibus 2–4 in seriem unicam dispositis in chromatophoro unoquoque; zygosporis ubi conjugatione scalariformi productis, quadratis, lateribus rectis vel levissime concavis interdum incrassatis, angulis incrassatis et cornutis, cornubus cylindricis et solidis e semigamitangiis reliquis formatis; membrana cornu delicatissime lamellosa.

Crass. cell. veget. 6·4–7·5 μ; diam. zygosp. (sine corn.) 22·5–27 μ.

Hab. Found sparingly amongst *Zygnema spontaneum*, *Gonatozygon monotænium*, etc., at the weedy margins of the Yan Yean Reservoir (Jan. 1906).

This is the narrowest described species of the genus *Debarya*, and in outward appearance presents many resemblances to *Mougeotia gracillima.*

The conjugating-tube is formed in the normal way and becomes very wide. During the fusion of the gametes the gametangia undergo a marked change. The terminal transverse walls increase greatly in thickness by the deposition of layer after layer of cellulose, and a slight thickening of the side walls also occurs. As this thickening goes on the cavity of the gametangium is gradually reduced and a hemispherical, or sometimes a bluntly conical mound of cellulose projects into the emptying gametangium. The metamorphosis of the gametangium, which might almost be described as a "solidification," keeps pace with the receding of the gametes, and when the latter have completely coalesced in the wide conjugating-tube, the proximal ends of the four solid processes project as four rounded buttons into the cavity of the zygospore. The mature zygospore possesses four cylindrical truncate horns, each of which has arisen without external change of form from one half of a gametangium, the latter having become *solid* by the deposition of an internal thickening of cellulose.

I have pointed out on previous occasions the curious change which is undergone by the gametangia of species of *Debarya* during conjugation *. In *D. desmidioides* there are four solid processes to each zygospore formed in a similar way to those of *D. Hardyi*. In *D. africana* the thickening is considerable, and laid down evenly except for the terminal pits, but the gametangia do not become solid.

The gradual acquirement of solidity by the erstwhile thin-walled gametangia of *D. Hardyi* is well shown in figs. 7–9, Pl. **2**.

Genus ZYGNEMA, *Ag.*

11. Zygnema spontaneum, *Nordst. Alg. aq. dulc. et Char. Sandvic.* 1878, p. 17, t. 1. figs. 23–24 ; *W. &. G. S. West, in Journ. Bot.* 1897, p. 40 ; *in Ann. Roy. Bot. Gardens, Calcutta*, vi. (1907) p. 184.—Z. Heydrichi, *Schmidle, in Flora*, lxxxiv. (1897) p. 169, t. 5. figs. 5–7, 10, 11.

Crass. cell. veget. 15·5–17 μ ; diam. zygosp. 29–34 μ ; diam. aplanospor. 20 μ. (Pl. **2**. figs. 2–3.)

Hab. Yan Yean Reservoir, at the weedy margins (Nov. and Dec. 1905 ; Jan. 1906).

In size and proportions, and also in the aplanospores, the Australian examples agreed almost exactly with those described by Nordstedt from the Sandwich Is., but the zygospores exhibited a considerable degree of variation in form and position. The zygospores previously observed from W. Africa and from Burma were entirely contained in the female gametangium, which was slightly swollen to accommodate the spore. In the Australian specimens the zygospores were of relatively greater diameter, and that part of the female gametangium in which the spore was lodged was of necessity much inflated, although the inflation was restricted to the exact place of lodgment. The conjugating-tubes were generally very wide and the zygospore projected into them, in some cases almost into the male gametangium. A few specimens were observed in which the zygospore was situated in the conjugating-tube midway between the two gametangia, and these examples afford further evidence of the identity of *Zygnema Heydrichi*, Schmidle, with *Z. spontaneum*. Schmidle's specimens were from near Sydney, and the conjugation was lateral, the zygospores being formed in the conjugating-tube. The Victorian specimens exhibited no lateral conjugation, but aplanospores were formed in filaments which in other parts were conjugating in a scalariform manner.

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* W. & G. S. West in Journ. Bot., March 1903, p. 8 ; G. S. West, Treatise Brit. Freshw. Alg. 1904, p. 127 ; in Journ. Linn. Soc., Bot. xxxviii. (1907) p. 104.

Family **DESMIDIACEÆ.**

Genus PENIUM, *Bréb.*

12. Penium margaritaceum, (*Ehrenb.*) *Bréb. in Ralfs, Brit. Desm.* (1848) p. 149, t. 25. figs. 1 *a–c*; *W. & G. S. West, Brit. Desm.* i. (1904) p. 83, t. 8. figs. 32–35.

Var. irregulare, *W. & G. S. West, in Trans. Bot. Soc. Edin.* xxiii. (1905) p. 14, t. 1. fig. 23.

Long. 142 μ; lat. max. 30 μ; lat. apic. circ. 20 μ.

Hab. Wallaby Creek Weir, at the outlet (July 1907).

Genus PLEUROTÆNIUM, *Näg.*

13. Pleurotænium mamillatum, *G. S. West, in Victorian Naturalist,* xxii. (1905) p. 70; *in Journ. Bot.* xliii. (1905) p. 252.

P. submediocre, modice elongatum, cellulis diametro 14–17-plo longioribus; semicellulæ subcylindricæ, leviter et gradatim attenuatæ e medio apicem versus, inflatione subprominenti ad basin et marginibus 10–11-undulatis, undulis gradatim minoribus apicem versus; apicibus convexo-truncatis, verrucis magnis conico-mamillatis (subunguiculatis) subdivergentibus 6–7 (visis 4) instructis; membrana subsparse punctata.

Long. 372–495 μ; lat. bas. semicell. 28–32 μ; lat. med. semicell. 27–31 μ; lat. apic. semicell. sine verruc. 17–29 μ, cum verruc. 21–25 μ. (Pl. **3**. figs. 1–2.)

Hab. Yan Yean Reservoir, in the plankton (Feb.–Apr. 1905) and at the weedy margins (July 1905), but more frequent in the plankton.

This species is readily distinguished by the large size and elongated character of the apical warts. The latter are mamillate in appearance, and possess a slight outward and upward curvature, which in some individuals is intensified until the warts become almost unguiculate. The total number of apical warts on any individual semicell may be six or seven. The margins of the semicells are undulate from base to apex, the undulations, which are 10 or 11 in number, becoming gradually less distinct towards the apex. The lower half of each semicell is approximately cylindrical, but the upper half is distinctly attenuated. Specimens of *P. mamillatum* are frequently found attached by their apices in pairs, separation of the cells not following immediately after division.

14. PLEUROTÆNIUM OVATUM, *Nordst. in Öfvers. af K. Vet.-Akad. Förh.* no. 3 (1877), p. 18.—Docidium ovatum, *Nordst.*, 1870.

Var. TUMIDUM, *Maskell, in Trans. N. Zeal. Instit.* xxi. (1889) p. 29, t. 6. fig. 54.—? Docidium rotundatum, *W. B. Turner, in K. Sv. Vet.-Akad. Handl.* xxv. no. 5 (1893), p. 37, t. 7. fig. 2 *a*.

Forma marginibus lateralibus superioribus semicellularum leviter concavis (=*Docidium pyriforme*, W. B. Turner, *l. c.* t. 7. fig. 3); tuberculis apicalibus magnitudinis variabilis 6–9; membrana laterum inferiorum incrassata.

Long. 241–262 μ; lat. max. 94–100 μ; lat. apic. 35–40 μ.

Hab. Yan Yean Reservoir, at the weedy margins (Nov. and Dec. 1905).

The form seen differs from that described by Maskell from New Zealand in the retuseness of the upper parts of the lateral margins of the semicells. Almost exactly the same form was observed from Cheltenham, Victoria: long. 240–255 μ; lat. max. 89–98 μ; lat. apic. 29·5–32·5 μ. *From the latter locality one zygospore was found* (consult Hardy in Victorian Naturalist, xxiii. (1906) p. 21). It was subglobose, externally smooth, and the wall consisted of three distinct coats, each of which was lamellose. The middle and inner coats had shrunk away from the outer one, especially at one side, and the middle coat was papillate, the papillæ being sparsely scattered, blunt, and 2–2·7 μ in length. Diam. zygosp. 96–108 μ. (Pl. **6**. fig. 9.) For a zygospore to possess a *papillate* middle coat is a most unusual occurrence.

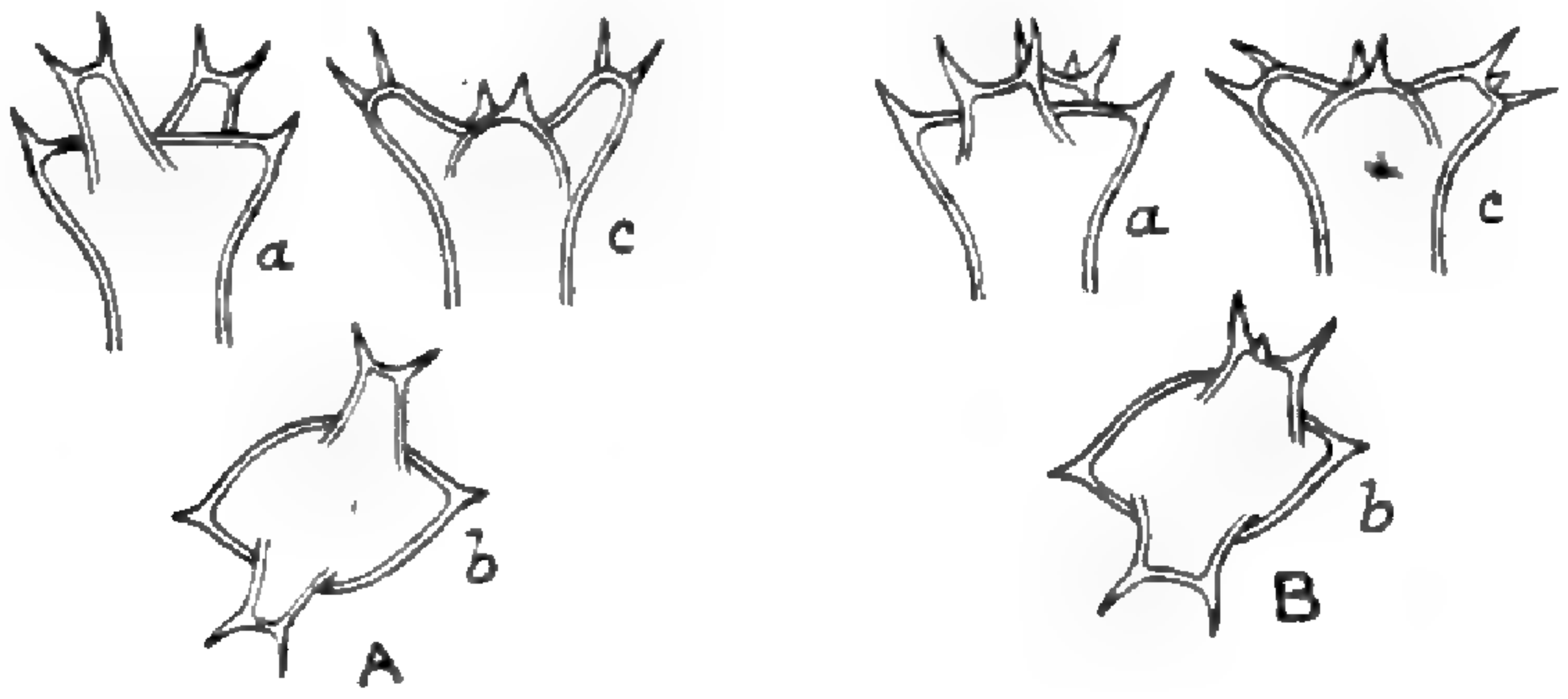
Genus TRIPLOCERAS, *Bail.*

15. TRIPLOCERAS GRACILE, *Bail. in Smithson. Contrib.* ii. (1851) p. 38, t. 1. fig. 10 [figure poor]; *Wittr. in Nov. Act. reg. Soc. Sci. Upsala*, vii. (1869) p. 21, t. 1. fig. 10 [figures not good].—T. gracile, *forma*, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1896) p. 236, t. 13. figs. 9–13. [*Etiam inclus.* T. gracile *forma* elongata, T. gracile *f.* gracillima, T. gracile *f.* quadriloba, *et* T. gracile *subsp.* bilobatum, *W. B. Turner, in K. Sv. Vet.-Akad. Handl.* xxv. no. 5 (1893), pp. 25, 26, t. 2. figs. 1–4.]

Turner's statement (*l. c.* p. 26) that "*Triploceras gracile* is perhaps the most polymorphic species known" is singularly near the mark, but whatever virtue the statement possessed he at once destroyed by naming four forms of this most variable species on characters which are not only trivial, but which appear to be founded mostly on inaccuracies of observation and drawing. *Triploceras gracile* certainly exhibits the widest range of variation of any known Desmid, and confusion has always existed as to which form, if any, should be regarded as the type-form.

The form described and figured as " *T. gracile*, forma " in the Trans. Linn. Soc. ser. 2, Bot. v. (1896) p. 236, t. 13. figs. 9–13, is the generally-distributed form in the United States, occurring from Maine to Florida. Bailey's original specimens were also collected in the eastern parts of the United States, and it is therefore highly probable that they were in no way different from this form. In fact, a close scrutiny of Bailey's figure, although a wretched drawing, confirms this opinion. Moreover, precisely the same form occurs in Central America, India, Ceylon, and Queensland. Taking all these facts into consideration, there is every reason for regarding this form as the type-form of the species *. The characters of importance of this form, which I shall henceforth consider as the type-form, are the whorls of acuminate verrucæ and the peculiar apical lobulation. The apex of each semicell is slightly flattened and is furnished with two divergent processes, somewhat obliquely disposed and bispinate (rarely trispinate) at their extremities. Alternating with these processes are two shorter apical lobes each of which terminates in an upwardly-curved spine. These more rounded lobes sometimes possess a subsidiary papilla (or even a spine) below the terminal one, and the relative proportions of the two spinate processes vary much. These variations, which are shown in the accompanying figures (text-fig. 7, A & B), in no way affect the distinctiveness of the apical characters. The number of whorls of acuminate verrucæ on a semicell is very variable (9–16), and the acuminate apices of these warts often graduate into shortly spinate apices. These are the limits of variation I have noticed in the type-form. Most of

Fig. 7.



Apices of two semicells of the type-form of *Triploceras gracile*, Bail.
In B the obliquely disposed processes are shorter and broader than in A.
a, front view ; *b*, apex seen from the vertical view ; *c*, side view. All × 500.

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* Dr. O. Borge has also regarded this form as the type. *Cf.* Borge, in Bih. till K. Sv. Vet.-Akad. Handl. xxii. no. 9 (1896), p. 28, t. 4. fig. 57.

the misconceptions in the past have resulted from the failure to realise the differences which the apex presents when viewed from various positions.

The second well-established form of *Triploceras gracile* is var. *bidentatum*, Nordst., in which the warts of the rings are bidentate. This well-known variety is frequent in Brazil, and has been found in India and New Zealand.

The three following varieties are less well known; they all occurred in the Yan Yean area of Victoria:—

Var. ACULEATUM, *Nordst.* [T. gracile, *subsp.* aculeatum, *Nordst. in Kongl. Sv. Vet.-Akad. Handl.* xxii. no. 8 (1888), p. 64, t. 7. figs. 13, 14.]

Forma aculeis verticillorum plus elongatis et patentibus; verticillis 8–9 in semicellula unaquaque.

Long. 238–260 μ; lat. bas. semicell. (sine acul.) 22 μ, cum acul. 36–38 μ; lat. apic. c. spin. 28–31 μ. (Pl. **3**. figs. 6–7.)

Hab. Yan Yean Reservoir, at the weedy margins (Mar. 1905); also in pools in Ottelia Creek (Sept. 1907).

The verticillate warts of the semicells were aculeate, but the aculei were more spreading than in Nordstedt's New Zealand specimens. Playfair has described a forma *australica* of this variety from New South Wales, but the Victorian forms all possessed more spreading spines.

Var. ROBUSTUM, var. n. (Pl. **3**. figs. 4–5.)

Var. major, elongatum et robustior, verticillis 16–18 in semicellula unaquaque, verrucis verticillorum mamillatis et spinatis; processibus duobus ad apicem semicellularum elongatis et robustis, 2–4-aculeatis.

Long. 560–584 μ; lat. bas. semicell. c. spin. 43–45 μ; lat. max. apic. c. spin. 60 μ.

Hab. Yan Yean Reservoir, at the weedy margins (Jan. 1906); also in pools in Ottelia Creek and in Honeysuckle Flat (Sept. 1907).

This large and handsome variety stands near to that described from New Zealand by Nordstedt as "var. *bidentatum* f. *intermedia*" (*cf.* Nordst. *l. c.* p. 64, t. 7. fig. 17).

Var. DENTICULATUM, nob. [=? T. denticulatum, *Playfair, in Proc. Linn. Soc. New South Wales*, xxxii. part. i. (1907) p. 164, t. 2. fig. 11.]

Var. verrucis verticillorum plerumque bispinatis (in parte apicali nonnunquam unispinatis), apice semicellulæ ut in var. *aculeato* verisimiliter.

Long. 388–464 μ; lat. bas. semicell. c. spin. 21·5–26 μ; lat. apic. semicell. c. spin. 19–27 μ. (Pl. **3**. figs. 8–10.)

Hab. Yan Yean Reservoir, at the weedy margins (Mar. 1905).

It does not seem possible to separate the form observed from Victoria from Playfair's *T. denticulatum*, as the double rings of spines are characteristic of each form. In the Victorian specimens, however, some of the upper rings (from 2–9) possess only a single series of spines as in the more typical forms of *Triploceras gracile*. Such a form as that figured on Pl. **3**. fig. 8 is clearly but a variety of *T. gracile*, notwithstanding the absolute agreement of the basal half of the semicell with *T. denticulatum*.

Although the three Australian forms from the Yan Yean area differ very considerably in the character of the verticillate warts, the apices all conform to one pattern, which on careful comparison is not so very different from that found in the type-form. No specimen was observed with three apical processes such as are figured by Playfair for *T. denticulatum*.

Genus EUASTRUM, *Ehrenb.*

16. EUASTRUM TURNERI, *West, in Journ. Linn. Soc., Bot.* xxix. (1892) p. 141, t. 20. fig. 18. ("*Eu.* sp. ad *E. denticulatum* accedens," Nordst. 1888.)

Forma MINOR.

Forma minor, granulis paucioribus.

Long. 21 μ; lat. 15·5 μ; lat. isthm. 5 μ.

Hab. Yan Yean Reservoir, at the weedy margins (common from Nov. 1905 to Jan. 1906).

Genus MICRASTERIAS, *Ag.*

17. MICRASTERIAS HARDYI, *G. S. West, in Victorian Naturalist*, xxii. (1905) p. 71, fig. 1; *Journ. Bot.* xliii. (1905) p. 253.

M. submagna, paullo longior quam lata, profundissime constricta, sinu valde aperto acutangulo ad extremum angustissimo semicellulæ trilobæ; lobo polari magno et leviter exerto, parte inferiore angusta cum marginibus subparallelis et cum serie denticulorum circ. 7 intra marginem lateralem unumquemque, apicibus cum verrucis emarginatis binis et processibus minutis brevibus emarginatis duobus asymmetrice dispositis, angulis superioribus in processus longos denticulatos gradatim attenuatos sursum divergentes productis; lobis lateralibus profundissime bilobulatis, lobulis magnis elongatis denticulatis divergentibus et gradatim attenuatis; apicibus lobulorum et processuum lobi polaris 4-dentatis; cum serie denticulorum intra lobulos laterales et processus lobi polaris; a vertice visæ anguste fusiformes, in parte mediana subrhomboideæ, apices versus gradatim attenuatæ in processus denticulatos quadridentatos productæ, marginibus lateralibus denticulatis.

Long. 198–235 μ; lat. 161–219 μ; lat. isthm. 16–18 μ; crass. 28 μ. (Pl. **5**. figs. 1–2.)

Hab. Yan Yean Reservoir, abundant in the plankton for the greater part of the year.

This handsome species belongs to that section of the genus including *Micrasterias americana* and *M. mahabuleshwarensis*, in which the polar lobe is furnished with accessory processes. It is at once distinguished from these species by the great length and divergence of the lateral lobules and the processes of the polar lobe. Accompanying this is a great reduction of the two accessory asymmetrical processes of the polar lobe, which are very minute, with smooth margins and bidenticulate apices.

M. Hardyi is one of the most conspicuous constituents of the plankton of the Yan Yean Reservoir, and for thirteen months it was never absent from the tow-nettings. It exhibits little variation, and only one abnormal specimen was observed among many thousands. In this individual the lateral lobes of one semicell were undivided, resembling the lateral lobes of *M. tropica* but much more attenuated. Large numbers of specimens were observed in various stages of cell-division, and in the young semicells the lateral lobes are always entire and bluntly rounded. The four teeth at the attenuated apices of the lobes are not easily all observed, but they were present in every specimen examined.

18. MICRASTERIAS THOMASIANA, *Archer, in Journ. Micr. Soc.* new ser. ii. (1862) p. 239, t. 12. figs. 1–5 ; *W. & G. S. West, Monogr. Brit. Desm.* ii. (1905) p. 110, t. 51. figs. 3–6.

Var. PULCHERRIMA, var. n. (Pl. **4**. fig. 1.)

Semicellulæ cum processu brevi bidentato extrorsum curvato intra basin lobuli lateralis uniuscujusque ; dente magno infra incisionem lobi lateralis superioris ; processibus lateralibus magnis duobus ad basin semicellularum dente magno superiore instructis.

Long. 219 μ ; lat. 197 μ ; lat. isthm. 30 μ ; crass. max. 65 μ.

Hab. Toorourong Reservoir, in the plankton (July 1907).

This beautiful Desmid was not uncommon in the tow-nettings obtained by boat from the Toorourong Reservoir, and was one of the only two Desmids present in the collections. It differs in a conspicuous manner from all other described forms of *M. Thomasiana* in the sixteen short, bidentate processes disposed one within each lateral lobule. The teeth within the divisions of the lateral lobes, 32 in the front view of a single cell, are present exactly as in the type, but there is an additional tooth close to the base of each superior lateral lobe, and there are some extra ones near the margin of each polar lobe. The larger, outwardly curved, lateral processes at the base of each semicell also possess an extra dorsal tooth of large size.

M. Thomasiana is known from the western parts of Europe, from the United States, and forms of it from Ceylon, Singapore, and Java.

Genus COSMARIUM, *Corda.*

19. COSMARIUM DORSITRUNCATUM, (*Nordst.*) *nob.*—C. Scenedesmus, *Delp.*, *var.* dorsitruncatum, *Nordst. in K. Sv. Vet.-Akad. Handl.* xxii. no. 8 (1888), p. 59, t. 3. fig. 15.

C. parvum, circiter 1¼-plo latius quam longum, profundissime constrictum, sinu angustissimo-lineari cum extremo leviter ampliato; semicellulæ depresso-subsemicirculares, angulis basalibus obtusis, apice leviter depresso; a vertice visæ anguste ellipticæ, polos versus leviter attenuatis; a latere visæ circulares; membrana subtilissima punctato-granulata; pyrenoidibus conspicuis *binis.*

Long. 30–32 μ; lat. 38–42 μ; lat. isthm. 12–14 μ; crass. 15–18 μ. (Pl. 4. fig. 4.)

Hab. Yan Yean Reservoir, at the weedy margins (Feb.–Apr., and also Oct. 1905).

This Desmid was described and figured from New Zealand as "*C. Scenedesmus β dorsitruncatum*" by Nordstedt, who was in doubt, however, concerning the nature of the chloroplasts. It has been recorded by Raciborski from the Centenial Park, Sydney (*vide* Rospraw. Wydz. matem.-przyr. Akad. Umiej. Krakow. xxii. (1892) p. 373), and that author states that the chloroplasts contain one pyrenoid. In this statement it would appear that Raciborski is incorrect. The specimens from Victoria were in absolute agreement with Nordstedt's published dimensions and with his figure, but in all cases every semicell possessed a partially subdivided axile chloroplast containing *two conspicuous pyrenoids.*

The cell-wall is most minutely granulate, so that the margin is very slightly rough. These granules are less evident in the centre of the semicells than near the margins.

C. dorsitruncatum differs from *C. depressum*, (Näg.) Lund. (= *C. Scenedesmus*, Delp.) in its narrow, closed sinus, in the semicircular-depressed form of the semicells, in the minute granulation of the cell-wall, and in the presence of two pyrenoids in the chloroplast. The poles of the vertical view are also more attenuated.

From *C. Pseudoscenedesmus*, W. & G. S. West (in Trans. Linn. Soc. ser. 2, Bot. vi. (1902) p. 164, t. 20. fig. 34), it is distinguished by its relatively greater length, its less deep constriction, its thicker vertical view, and by the dense but exceedingly fine granulation of the cell-wall.

Quite recently Gutwinski has described a plant from Java under the name of "*C. dorsitruncatiforme*" (*vide* Bull. Acad. Sci. Cracovie, Nov. 1902, p. 592, t. 38. fig. 35). This is, however, merely one of the common tropical forms (rather small) of typical *C. obsoletum*, (Hantzsch) Reinsch, and is mentioned as occurring in Koh Chang in the Gulf of Siam in Botan. Tidsskr.

xxiv. (1901) p. 87. The same form has been observed by Lütkemüller from Central China.

20. Cosmarium moniliforme, (*Turp.*) *Ralfs*, *Brit. Desm.* 1848, p. 107, t. 17. fig. 6.

Var. limneticum, *W. & G. S. West*, *Monogr. Brit. Desm.* iii. (1908) p. 23, t. 67. figs. 6, 7.

Long. 49–52 μ ; lat. 26–29 μ ; lat. isthm. 18 μ. (Pl. **5**. fig. 15.)

Hab. Yan Yean Reservoir, in the plankton and at the weedy margins.

This variety was most abundant in the plankton in March 1907, but it reached its greatest profusion among the weeds in July. Chains of four individuals were not uncommon. The broad isthmus and the thickened poles easily differentiate it from other forms of the species.

21. Cosmarium affine, *Racib. in Rospraw. Wydz. matem.-przyr. Akad. Umiej. Krakow.* ser. 2, xxii. (1892) p. 363, t. 6. fig. 25.

Var. excavatum, var. n. (Pl. **5**. fig. 7.)

Var. semicellulis ad medium apicis minute excavatis ; membrana glabra.

Long. 16·4 μ ; lat. 11·8 μ ; lat. isthm. 8·5 μ ; crass. 9·3 μ.

Hab. Yan Yean Reservoir, at the weedy margins (Mar. 1905).

22. Cosmarium tortum, *Lagerh. & Nordst. in Wittr., Nordst., et Lagerh. Alg. Exsic.* no. 1486 (1903), fasc. 35, pp. 16, 17 (cum fig.).

Forma trigona, f. n. (Pl. **5**. figs. 3–4.)

Forma cellulis a vertice visis rotundo-trigonis, angulis levissime producto-submamillatis ; membrana delicatissime punctulata.

Long. 21–24 μ ; lat. 15–16 μ ; lat. isthm. 10 μ.

Hab. Yan Yean Reservoir, in the plankton (Feb.–Apr. 1905, very abundant ; Jan. and Feb. 1906).

This small species, which might equally well be placed as *Staurastrum tortum*, is a connecting-link between the genera *Cosmarium* and *Staurastrum*. The twisting of the cells at the isthmus is a much commoner and more marked feature of *Staurastrum* than of *Cosmarium*, and the discovery of this trigonal form adds weight to the suggestion that the species would perhaps be better transferred to the former genus.

23. Cosmarium tjibenongense, *Gutw. in Bull. Acad. Sci. Cracovie*, Nov. 1902, p. 591, t. 38. fig. 34.

Forma minor, semicellulis plus regulariter elliptico-hexagonis ; chromatophoris centralibus cum pyrenoide singulo et lobis compressis radiatis.

Long. 33 μ ; lat. 22–23 μ ; lat. isthm. 5 μ. (Pl. **4**. fig. 3.)

Hab. Yan Yean Reservoir, at the weedy margin (June 1905).

This deeply constricted *Cosmarium* appears to be referable to *C. tjibenongense*, Gutw., but the specimens possessed more regular semicells than would be inferred from Gutwinski's figure. It seems most closely allied to *C. contractum*, Kirchn., differing in the hexagonal form of the semicells and in its lobed chloroplasts.

24. COSMARIUM PERFISSUM, sp. n. (Pl. **4.** fig. 2.)

C. parvum, circiter $1\frac{1}{4}$-plo latius quam longum, profundissime constrictum, sinu aperto (ad apicem angusto sed extrorsum gradatim ampliato); semicellulæ anguste oblongo-ellipticæ, ventre leviter convexiore quam dorso, in medio apicis cum undulis minutissimis binis; a vertice visæ anguste oblongo-ellipticæ, ad medium utrobique leviter inflatis; a latere visæ subcirculares; membrana subtiliter scrobiculato-punctata; pyrenoidibus singulis.

Long. 23–24 μ; lat. 30–31 μ; lat. isthm. 4 μ; crass. 13 μ.

Hab. Yan Yean Reservoir, in the plankton (Mar.–May 1905) and at the weedy margins (Mar.–July and Dec. 1905).

This species is a near relative of *C. depressum*, (Näg.) Lund., but as it possesses very constant characters which readily distinguish it and render it easy of recognition at all times, it is perhaps best to regard it as specifically distinct. A form of *C. Phaseolus* occurred amongst it, but the two Desmids were obviously not the same. *C. perfissum* is distinguished from *C. depressum* by its deeper constriction, its very narrow isthmus, the more open sinus, the presence of the two minute undulations in the middle of each apex, and by the slight inflation on each side of the vertical view. The cell-wall is also more distantly punctated, and the punctulations themselves are larger.

25. COSMARIUM PHASEOLUS, *Bréb. in Menegh. 'Synops. Desm.,' Linnæa* (1840), p. 220; *W. & G. S. West, Brit. Desm.* ii. (1905) p. 158, t. 60. figs. 12–14.

Forma semicellulis depressis, tumore centrali reducto et minute punctulato.

Long. 28–30 μ; lat. 28–30 μ; lat. isthm. 7 μ; crass. 14·5 μ. (Pl. **4.** fig. 7.)

Hab. Yan Yean Reservoir, at the weedy margins (Mar., Apr., June, July, and Dec. 1905; Jan. 1906).

26. COSMARIUM ACHONDROIDES, sp. n. (Pl. **4.** figs. 9–10.)

C. mediocre, circiter tam longum quam latum, profundissime constrictum, sinu ad apicem angusto sed extrorsum valde aperto; semicellulæ subhexagono-ellipticæ, dorso convexiore quam ventre, angulis lateralibus subrotundatis, apice in medio subrecto vel levissime retuso; a vertice visæ ellipticæ; a latere visæ subcirculares; membrana punctata; chromatophoris parietalibus circiter 8 in semicellula unaquaque, tænia unaquaque late et irregulare cum pyrenoide singulo.

Long. 76–80 μ; lat. 72–78 μ; lat. isthm. 16–17·5 μ; crass. 38 μ.

Hab. Yan Yean Reservoir, in the plankton and at the weedy margins throughout the greater part of the year. Among the weeds it was at its maximum abundance in March.

In general appearance *Cosmarium achondroides* somewhat resembles *C. depressum* var. *achondrum*, (Boldt) W. & G. S. West, especially some of the large forms which occur in the British freshwater plankton. It is distinguished, however, by the form of the semicells, which have a more continuously rounded ventral border, and by the peculiar chloroplasts. The latter are disposed as broad parietal bands, with irregular margins. One pyrenoid is present in each parietal chloroplast, but its position relative to the centre of the semicell is very variable.

27. COSMARIUM PSEUDOPROTUBERANS, *Kirchn. Alg. Schles.* 1878, p. 150.

Var. ANGUSTIUS, *Nordst. in K. Sv. Vet.-Akad. Handl.* xxii. no. 8 (1888), p. 58, t. 6. figs. 15, 16.

Long. 28–35 μ; lat. 23–28 μ; lat. isthm. 6–8 μ.

Hab. Yan Yean Reservoir, at the weedy margins (Dec. 1905 and Jan. 1906).

Many of the Desmids recorded as *C. Elfvingii*, Racib. (= *C. hexagonum*, Elfv. *non* Nordst.), should be transferred to this variety of *C. pseudoprotuberans*. The Victorian forms were delicately punctate as in the New Zealand specimens, and some of them possessed the minute papilla at the basal angles of the semicells described by Raciborski in his *C. Elfvingii* var. *saxonicum* (*vide* Pamietnik. Wydz. matem.-przyr. Akad. Umiej. Krakow. xvii. (1889) p. 780, t. 5. fig. 14).

28. COSMARIUM CAPITULUM, *Roy & Biss. in Journ. Bot.* 1886, p. 195, t. 268. fig. 9.

Var. AUSTRALE, *G. S. West, in Victorian Naturalist*, xxii. (1905) p. 71; *in Journ. Bot.* xliii. (1905) p. 253.

Var. ventre semicellulæ minore, angulis capitulis leviter sursum divergentibus.

Long. 16–19 μ; lat. 20–23 μ; lat. isthm. 5·5–6 μ; crass. 8·5–9 μ. (Pl. **5**. fig. 6.)

Hab. Yan Yean Reservoir, at the weedy margins and in the plankton from Nov. to July, sometimes very abundant.

The upwardly diverging angles of this variety give the semicells a relatively straighter apex than in the type. The ventral part of the body of the semicell is also much less developed.

It is interesting to note that a stout northern variety of this species (var. *grœnlandicum*, Börgesen) occurs in the plankton of certain lakes in Scotland and in the Faeroë Is.

29. COSMARIUM MURRAYI, *Playfair, in Proc. Linn. Soc. N. S. Wales*, xxxii. part i. (1907) p. 195, t. 5. fig. 19.

The specimens of this Desmid observed from Victoria were not in strict agreement with either the description or figure given by Playfair. The sinus was rather deeper, and the projecting apex, although widely truncate, possessed somewhat rounder angles and a pair of minute median undulations. From the vertical view the semicells were broadly elliptic, and every individual showed a very small, somewhat faint protuberance at the middle on each side. This minute protuberance is situated nearer the apex than the base of the semicell and is rather more evident in the side view. The basal angles of the semicells are also slightly thickened and projecting, a fact which although faintly indicated in Playfair's figure, is omitted from his description.

Long. 20–21 μ; lat. 17–18 μ; lat. isthm. 5 μ; crass. 10 μ. (Pl. **4**. fig. 5.)

Hab. Yan Yean Reservoir, among weeds at the margin (Nov. 1905).

30. COSMARIUM QUADRATULUM, (*F. Gay*) *De Toni, Syll. Alg.* (1889) p. 934. —Euastrum quadratulum, *F. Gay, Monogr. loc. Conj. Montpellier* (1884), p. 58, t. 1. fig. 15.

Long. 12·5–14·5 μ; lat. 11·2–12·7 μ; lat. isthm. 3–3·4 μ. (Pl. **4**. fig. 12.)

Hab. Yan Yean Reservoir, at the weedy margins (Nov. 1905 to Jan. 1906; abundant).

This minute Desmid was observed in great abundance, and as its characters were remarkably constant I think it is best retained as a species. The somewhat peculiar angularity of the semicells and the widely retuse apices are features which at once distinguish it from *C. norimbergense* or any of the forms of *C. Meneghinii.*

31. COSMARIUM TRACHYPLEURUM, *Lund. in Act. R. Soc. Sci. Upsal.* ser. 3, viii. (1871) p. 27, t. 2. fig. 12.

Var. SUBGLABRUM, var. n. (Pl. **4**. fig. 11.)

Var. angulis basalibus semicellularum subrectangularibus, granulis in centro semicellularum nullis.

Long. 46 μ; lat. 40 μ; lat. isthm. 14 μ; crass. 23–24 μ.

Hab. Wallaby Creek Weir, in the plankton (July 1907).

This variety differs from all other described forms of *C. trachypleurum* in the entire absence of the central granules.

32. Cosmarium subtriordinatum, *W. & G. S. West, in Journ Bot.*, April (1897), p. 122, t. 368. fig. 11.

Forma ad var. *rotundatum*, Schmidle, accedens, sinu extrorsum plus ampliato ; granulis magnis (vel verrucis) paucis 8–9 in centro semicellularum in seriebus verticalibus multe irregularibus tribus.

Long. 24 μ ; lat. 24 μ ; lat. isthm. 6·5 μ ; crass. 14·5 μ. (Pl. **4**. fig. 6.)

Hab. Yan Yean Reservoir, in the plankton (Feb. and Mar. 1905, and Feb. 1906) and at the weedy margins (Mar.–May, Nov. and Dec. 1905, and Jan. 1906).

This *Cosmarium* was never abundant, but for about six months it occurred sparingly in the weed collections. It differs from the original African form principally in the more open sinus, in which feature it agrees with the var. *rotundatum* described by Schmidle from Zanzibar and Mozambique (*vide* Engler, Bot. Jahrbüch. xxvi. (1898) p. 36, t. 2. fig. 21).

33. Cosmarium amœnum, *Bréb. in Ralfs, Brit. Desm.* (1848) p. 102, t. 17. fig. 3.

Var. mediolæve, *Nordst. in K. Sv. Vet.-Akad. Handl.* xxii. no. 8 (1888), p. 50, t. 5. fig. 12.

Long. 45–54 μ ; lat. 26–32 μ ; lat. isthm. 9–10·5 μ ; crass. 16·5–17·5 μ.

Hab. Yan Yean Reservoir, at the weedy margins.

This Desmid was fairly general throughout the year at the weedy margins of the lake, reaching its greatest abundance in February. It was also frequent at Heidelberg, Victoria, in March 1905. The specimens were in all cases smaller than those described from New Zealand, having dimensions more in accordance with the typical plant. The granules of this variety are much smaller than in the type form, and not only are they wanting in the centre of the semicells, but their arrangement is quite different.

34. Cosmarium Hardyi, *G. S. West, in Victorian Naturalist*, xxii. (1905) p. 72 ; *in Journ. Bot.* xliii. (1905) p. 253.

C. mediocre, circiter 1½-plo longius quam latum, profunde constrictum, sinu breviter lineari extremo ampliato et extrorsum valde aperto; semicellulæ subsphærico-semicirculares, lateribus et angulis inferioribus late rotundatis granulis minutis subpapilliformibus instructis, apice levissime truncato et glabro, intra margines laterales et infra apicem granulis minutissimis irregulariter ordinatis præditæ ; in parte magna mediana semicellularum cum scrobiculis confertis quincuncialiter ordinatis ; a latere visæ subsphæricæ, apice subdepresso-truncato ; a vertice visæ late ellipticæ et latissime tumidæ utrobique, polis granulato-subpapillatis, lateribus scrobiculatis.

Long. 84–89 μ ; lat. 56–61 μ ; lat. isth. 20–22 μ ; crass. 50–52 μ. (Pl. **4**. fig. 8.)

Hab. Yan Yean Reservoir, in the plankton throughout most of the year (very common in Apr. 1905 and Feb. 1906); also rare at the weedy margins (Apr. and May, 1905).

Cosmarium Hardyi is a very characteristic species. The form of its semicells, with their granulate lower margins, and the numerous central scrobiculations easily distinguish it from any others with which it might be confused. Its great thickness is also a distinctive feature.

35. COSMARIUM AMPLUM, *Nordst. in Bot. Notis.* (1887) p. 163; *l. c.* (1888) p. 63, t. 6. fig. 20.

Long. 130–135 μ; lat. 92–97 μ; lat. isthm. 28–29 μ.

Hab. Pool in the Yan Yean Catchment area, common (Sept. 1907).

Genus XANTHIDIUM, *Ehrenb.*

36. XANTHIDIUM HASTIFERUM, *W. B. Turn. in Journ. Roy. Micr. Soc.* ser. 2, v. (1885) p. 938, t. 15. fig. 20.—X. Antilopæum *var.* angulatum, *Josh.* (1886).

Forma cellulis latioribus, apicibus paullo elevatis; spinis apicalibus reductis, singulis vel binis, nonnunquam papillatis vel rarissime nullis.

Long. s. spin. 45–46 μ; lat. s. spin. 48–50 μ, c. spin. 85–98 μ; lat. isthm. 10–11 μ.

Hab. Yan Yean Reservoir, in the plankton (Mar. and April, 1905) and at the weedy margins (Mar., May, and June, 1905).

This form is of interest as it connects the typical plant with the New Zealand var. *inevolutum,* Nordst. (K. Sv. Vet.-Akad. Handl. xxii. no. 8 (1880), p. 43, t. 4. fig. 24). It is quite possible that the semicell upon which Nordstedt founded his New Zealand variety belongs to the same form as the Victorian specimens, as semicells of the latter were occasionally destitute of the shorter apical spines.

Genus ARTHRODESMUS, *Ehrenb.*

37. ARTHRODESMUS INCUS, (*Bréb.*) *Hass. Brit. Freshw. Alg.* (1845) p. 357; *Ralfs, Brit. Desm.* (1848) p. 118, t. 20. figs. 4 *a–d.*

Two forms were noticed in moderate abundance.

Forma *a.* Large form of fairly typical shape, with strong divergent spines.

Long. s. spin. 25 μ; lat. s. spin. 26–28 μ, c. spin. 53–56 μ; lat. isthm. 6 μ.

Forma *b.* Small form somewhat resembling *A. phimus,* W. B. Turn., var. *occidentalis,* W. & G. S. West (in Trans. Roy. Irish Acad. xxxii. (1902) p. 58, t. 2. fig. 17), but with a straight apex.

Long. 16 μ; lat. s. spin. 17–18 μ, c. spin. 22–23 μ; lat. isthm. 4·5–5 μ.

Hab. Yan Yean Reservoir. Both forms occurred in the plankton and at the weedy margin of the lake; forma *a* was much more frequently met with than forma *b.*

38. ARTHRODESMUS TRIANGULARIS, *Lagerh. in Öfvers. K. Vet.-Akad. Förh.* xlii. (1885) p. 244, t. 27. fig. 22.

Forma MINOR. [= *A. Incus*, forma, *Racib. in Rospraw. Wydz. matem.-przyr. Akad. Umiej. Krakow.* ser. 2, xxii. (1892) p. 377, t. 7. fig. 25; A. Incus, *forma* Saidæ, *Eich. & Racib. ibid.* xxvi. (1893) p. 120.]

Long. 17–18 μ; lat. s. spin. 11·5–12·5 μ, c. spin. 35–37·5 μ; lat. isthm. 4 μ.

Hab. Yan Yean Reservoir, in the plankton and at the weedy margin.

Genus STAURASTRUM, *Meyen*.

39. STAURASTRUM MUCRONATUM, *Ralfs, in Ann. Nat. Hist.* (1845) p. 152, t. 10. fig. 6.

Var. DELICATULUM, *G. S. West, in Victorian Naturalist*, xxii. (1905) p. 72; *in Journ. Bot.* xliii. (1905) p. 254.

Var. semicellulis elliptico-fusiformibus, angulis lateralibus submamillatis et delicatissime apiculatis.

Long. 32·5–35 μ; lat. 34–37 μ; lat. isthm. 6–7 μ. (Pl. **5.** fig. 5.)

Hab. Yan Yean Reservoir, in the plankton (very common, Feb. and Mar. 1905) and at the weedy margins (very rare, May and July, 1905).

40. STAURASTRUM MUTICUM, *Bréb. in Menegh. Synops. Desm., Linnæa* (1840) p. 228; *in Ralfs, Brit. Desm.* (1848) p. 125, t. 21. fig. 4, t. 34. fig. 13.

Var. VICTORIENSE, *G. S. West, in Vict. Nat. l. c.*; *Journ. Bot. l. c.*

Var. cellulis longioribus quam in forma typica; semicellulis late ellipticis; membrana delicatissime punctata.

Long. 30 μ; lat. 20·5 μ; lat. isthm. 7·5 μ. (Pl. **5.** fig. 8.)

Hab. Yan Yean Reservoir, in the plankton (most abundant from Mar. to May, 1905) and at the weedy margins (common in June, 1905).

41. STAURASTRUM DIGITATUM, sp. n. (Pl. **5.** figs. 11–12.)

S. parvum, circiter 1⅔-plo latius quam longum (cum processibus), leviter constrictum, sinu minuto; semicellulæ subglobosæ, cum processibus elongatis glabris et leviter divergentibus apicem versus utroque, processu unoquoque gradatim attenuato sed constrictione minuto ad basin, apicibus processuum obtusis; a vertice visæ corpore circulari, cum processibus elongatis glabris 4–5-radiatis; membrana tenue et glabra.

Long. s. proc. 19–21 μ, c. proc. 30–32 μ; lat. s. proc. 12–13 μ, c. proc. 48–52 μ; lat. isthm. 8–9·5 μ.

Hab. Yan Yean Reservoir, at the weedy margins (Mar. and Apr. 1905).

This species is a close ally of *S. lævispinum*, Bissett, *S. sublævispinum*, W. & G. S. West, and *S. subnudibrachiatum*, W. & G. S. West. It stands nearest to *S. lævispinum* var. *tropicum*, W. & G. S. West. (in Ann. Roy.

Bot. Gard. Calcutta, vi. (1907) p. 215, t. 16. fig. 1), which is known from Burma, but differs in the more elongated processes, each of which is constricted at the base, and in the proportionately smaller body of the semicells. In all forms of *Staurastrum lævispinum* the processes gradually merge into the body of the semicell from a dilated base, whereas in *S. digitatum*, as in *S. victoriense*, the processes are narrowed at the base and attached at definite points to the body of the semicell.

The cell-wall is very thin, and the processes are hollow, a lobe of the chloroplast passing into each process and extending almost to its apex.

42. STAURASTRUM VICTORIENSE, sp. n. (Pl. **5.** figs. 13–15.)—S. nudibrachiatum, *Borge*, *var.* victoriense, *G. S. West*, *in Victorian Naturalist*, xxii. (1905) p. 72 ; *in Journ. Bot.* xliii. (1905) p. 253.

S. mediocre, circiter 1½-plo latius quam longum (cum processibus), levissime constrictum, sinu minimo vix conspicuo ; semicellulæ subhemisphærico-globosæ, apice valde convexo (non depresso in parte mediana), corona processuum longorum leviter sursum divergentium 10–11 præditæ ; processibus rectis glabrisque, ad basin leviter constrictis et apicem versus gradatim attenuatis, apicibus processuum integris et obtuse conicis ; a vertice visæ circulares, processibus glabris 10–11-radiatis ; chromatophoris ut in *S. nudibrachiato* ; membrana corporis subtiliter et irregulariter punctata, membrana processuum tenuiore et glabra.

Long. s. proc. 45–46 μ ; lat. sine proc. 35–36·5 μ, c. proc. 79–96 μ ; lat. isthm. 31 μ ; crass. proc. 4·8–5·8 μ ; long. proc. 25–34 μ.

Hab. Yan Yean Reservoir, in the plankton (somewhat scarce throughout the entire year) and at the weedy margins (April–July, 1905 ; common in June and July).

This curious species stands nearest to *S. nudibrachiatum*, Borge (in Arkiv Botan. K. Sv. Vet.-Akad. Bd. i. (1903) p. 109, t. 4. fig. 20), a Desmid recently described from Brazil ; but as the characters of the Victorian plant are remarkably constant, and it can be so easily distinguished from the Brazilian plant, I have thought it advisable to place it as a distinct species.

The Australian species differs from the Brazilian one in the proportionately longer body of the cells, the slighter constriction, the narrower processes *with entire apices*, and in the greater number of processes on each semicell.

No specimens were observed with any trace of teeth at the apices of the processes. The walls of the processes are much thinner than those of the body of the *Staurastrum*, and are perfectly smooth, whereas the rounded semicells are distinctly punctate. Each process is slightly constricted at the base, the widest part being about one-third the length from the base. All the specimens seen were either 10- or 11-radiate in vertical view.

Compare also with *S. subnudibrachiatum*, W. & G. S. West.

43. Staurastrum lævispinum, *Biss. in Journ. Roy. Micr. Soc.* (1884) p. 195, t. 5. fig. 5.

Var. subbrachiatum, *G. S. West, in Victorian Naturalist*, xxii. (1905) p. 72; *in Journ. Bot.* xliii. (1905) p. 253.

Var. processibus angustioribus basin versus et sæpe emarginato-furcatos ad apices.

Long. s. proc. 17–18·5 μ, cum proc. 30–35 μ; lat. 11–12 μ, c. proc. 30–32 μ; lat. isthm. 6·5–7 μ. (Pl. **5**. fig. 10.)

Hab. Yan Yean Reservoir, in the plankton (Mar. and Apr. 1905).

This variety is distinguished by the greater differentiation which exists between the processes and the body of the semicells. Some or all of these processes are often emarginate at the apex.

It should be compared with *S. lævispinum* forma *sydneyensis*, Racib. (in Rospraw Wydz. matem.-przyr. Akad. Umiej. Krakow. xxii. (1892) p. 379 t. 7. fig. 10).

44. Staurastrum senarium, (*Ehrenb.*) *Ralfs, Brit. Desm.* 1848, p. 216; *Wolle, Desm. U. S.* 1884, p. 147, t. 52. fig. 1; *W. B. Turner, in K. Sv. Vet.-Akad. Handl.* Bd. 25, no. 5 (1893) p. 119, t. 15. fig. 13.—S. pseudopisciforme, *Eichl. & Gutw.*, var. denticulatum, *Lütkem. in Ann. k. k. Nat. Hofmus. Wien*, Bd. xv. (1900) p. 124, t. 6. figs. 37, 38.

Long. 42–46 μ; lat. c. proc. 46–58 μ; lat. isthm. 11–15 μ. (Pl. **6**. fig. 13.)

Hab. Yan Yean Reservoir, in the plankton (Mar.–May, 1905) and at the weedy margins (Mar.–July, 1905).

Much doubt prevails concerning the exact identity of *Staurastrum senarium*, although it is generally accepted as a species closely akin to *S. furcatum*, Ehrenb., but provided with twelve accessory processes in place of the six which are so characteristic of the latter species. The Australian plants reached their maximum abundance in April. Six of the accessory processes were in the same plane as the three angular processes, and six were apical. The angles of the semicells were gradually produced into a slightly divergent process which was either quite smooth or furnished with a ring of four small denticulations. The presence of these denticulations is a feature of little importance, as they may be present on the angular processes of one semicell, but absent from those of the other.

45. Staurastrum patens, *W. B. Turn. in K. Sv. Vet.-Akad. Handl.* Bd. 25, no. 5 (1893) p. 108, t. 14. fig. 21.

Var. planctonicum, *G. S. West, in Victorian Naturalist*, xxii. (1905) p. 73; *in Journ. Bot.* xliii. (1905) p. 254.—S. patens f. australica, *Playfair, in Proc. Linn. Soc. N. S. Wales*, xxxii. pt. 1 (1907), p. 189, t. 5. fig. 9.

Var. paullo minor, angulis leviter productis trispinatis; semicellulæ a vertice visæ lateribus subrectis, angulis leviter productis et trispinatis.

Long. s. spin. 32 μ, c. spin. 52–56 μ; lat. s. spin. 38–44 μ, c. spin. 58–66 μ; lat. isthm. 11·5 μ. (Pl. **6**. fig. 14.)

Hab. Yan Yean Reservoir, in the plankton (Feb.–May, 1905).

Judging by the front view only the Australian forms are unquestionably *Staurastrum patens*, W. B. Turn., but the drawing given by Turner of the vertical view does not seem to me to be correct. Assuming this to be the case, the only striking difference between the Australian and Indian forms is the presence of three large spines instead of two at each angle. The elevated triangular platform on the apex of each semicell is furnished with a pair of denticulations near each angle and within the lateral margins. This same variety has also been described by Playfair (under the name of "forma *australica*") from New South Wales.

S. patens should be compared with *S. Freemanii* var. *triquetrum*, W. & G. S. West ('Freshw. Alg. Ceylon,' Trans. Linn. Soc. ser. 2, Bot. vi. (1902) p. 177, t. 21. fig. 22).

S. javanicum, Gutw. ('Alg. Java,' Bull. de l'Acad. Sci. Cracovie (1902) p. 604, t. 39. fig. 59), does not differ sufficiently from *S. patens* to warrant separation as a distinct species.

46. STAURASTRUM UNICORNE, *W. B. Turn. l. c.* p. 107, t. 15. fig. 16.

Var. NODIFERUM, (*W. B. Turn.*) *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* vi. (1902) p. 175.—S nodiferum, *W. B. Turn. l. c.* p. 130, t. 14. fig. 26.

Forma minor, aculeis curvatis 4–5 ad capitulos processuum; semicellulæ a vertice visæ lateribus subrectis et constrictione infra angulos capitatos prominentiore.

Long. c. spin. 18–20 μ; lat. c. spin. 18–19 μ; lat. isthm. 4 μ. (Pl. **3**. fig. 11.)

Hab. Yan Yean Reservoir, at the weedy margins (Mar. 1905).

S. unicorne appears to be a species with an eastern distribution, and the extension of a small form of it as far south as Victoria is decidedly interesting. The extreme forms of the species are rather different in appearance, but the connecting forms are numerous and include a large series of intermediate states.

The form under consideration is the smallest yet found, and differs from all other known forms in the straightness of the sides of the vertical view. From four to five curved aculei are attached to each capitate angle.

47. STAURASTRUM STRIOLATUM, (*Näg.*) *Archer, in Pritch. Infus.* (1861) p. 740; *Nordst. in Vidensk. Medd. Naturh. Foren. Kjöbenh.* (1869) p. 225, t. 4. fig. 45.

Long. 21–23 μ; lat. 21–24·5 μ; lat. isthm. 7–8 μ; diam. zygosp. 37–39 μ; crass. zygosp. 24 μ. (Pl. **6**. figs. 10–12.)

Hab. Ottelia Creek, Yan Yean Reservoir, in pools (3 Sept. 1907).

Several zygospores of this species were observed, and they were of a type most unusual in the genus *Staurastrum*. They were considerably flattened or compressed, being oblong in the side view, but having a circular outline in the front view with 10–12 prominent marginal undulations. These undulations were not caused by wart-like elevations but by ridges extending from one flattened side to the other.

Wittrock has described a similar zygospore from Öland which he referred to *S. striolatum* var. *oelandicum* (*vide* Wittr. in Bih. till K. Sv. Vet.-Akad. Handl. Bd. i. no. 1 (1872) p. 52), but I can see no essential differences between Wittrock's variety and typical *S. striolatum*.

The zygospore of *S. dilatatum*, as described by Messrs. Roy and Bissett, is of a similar nature to that of *S. striolatum*, but, according to Ralfs, that of *S. alternans* is globular and furnished with forked spines.

48. Staurastrum neglectum, sp. n. (Pl. **3**. fig. 12.) S. tricorne, (*Bréb.*) *Menegh. var. β, Ralfs, Brit. Desm.* (1848) p. 134, t. 34. figs. 8 *b*, *c*, *d*.

S. parvum, 1¼–1½-plo latius quam longum (cum processibus), minutissime (vix conspicue) constrictum; semicellulæ parte basali breviter cylindrica, parte superiore incudiformi apice convexo, angulis in processus attenuatos minute denticulatos horizontaliter dispositos productis; a vertice visæ triangulares, lateribus corporis parvæ concavis, angulis in processus attenuatos sublongos rectus vel leviter curvatos productis; processibus cum annulis denticulorum minutorum 6–7 præditis, apices versus leviter dilatatis et apicibus tridenticulatis; cellulæ plerumque tortæ, nonnunquam processibus alterius semicellulæ cum iis alterius alternantibus.

Long. 23·5–26 μ; lat. c. proc. 32–35 μ; lat. med. cell. 6·5–7 μ.

Hab. Yan Yean Reservoir, among weeds at the margin (Jan. 1906), and in pool in the catchment area (Sept. 1907).

This species differs from *S. hexacerum*, (Ehrenb.) Wittr. (=*S. tricorne*, as described and figured by Ralfs), in the smaller body of the semicells, the cylindrical median part of the cells, with the faintest indication of a constriction, and in the more elongate processes. The latter are also much more elegant and are dilated towards the extremities. Ralfs figured the zygospores of both *S. hexacerum* and *S. neglectum* (=*S. tricorne*, var. β, Ralfs), and that of the latter is distinguished by the repeated furcation of the extremities of the spines (*vide* Ralfs, Brit. Desm. t. 34. fig. 8 *d*).

S. neglectum is widely distributed, although rare, in the British Islands, and I have also examined specimens from Maine in the United States.

49. Staurastrum bibrachiatum, *Reinsch, Contrib. Alg. et Fung.* (1875) p. 85, t. 16. fig. 2.

Var. cymatium, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 74, t. 8. fig. 28.

Cellulæ plerumque tortæ; long. cum proc. 35–39 μ; lat. cum proc. 39–44 μ; lat. isthm. 4·5 μ; crass. 7·5–8 μ. (Pl. **6**. figs. 15–16.)

Hab. Yan Yean Reservoir, at the weedy margins (July, Nov., and Dec. 1905; Jan. 1906).

This peculiar *Staurastrum* was particularly common in July. The specimens agreed very well with those originally described from Madagascar, but the cells in nearly all cases were twisted at the isthmus, and the processes were minutely tridenticulate. Bohlin has recorded this *Staurastrum* from the Azores (*vide* Bohlin, in Bih. till K. Sv. Vet. -Akad. Handl. Bd. 27, no. 4 (1901) p. 55, fig. 13), but was greatly in error in regarding it as allied to *S. gracillimum* var. *biradiatum*, W. & G. S. West. The Desmid which Bohlin mentions and figures under the name of *S. gracillimum* var. *biradiatum* is typical *S. tetracerum*, Ralfs, and there is little question that *S. bibrachiatum* var. *cymatium* has had a direct origin from *S. tetracerum*. Specimens in which one semicell agrees with *S. tetracerum* are occasionally observed (Pl. **6**. fig. 15; also Bohlin, *l. c.* fig. 13), and the denticulation of the processes is the same. The marked twisting of the cells at the isthmus is also a character in common with *S. tetracerum*.

50. STAURASTRUM EXCAVATUM, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1895) p. 78, t. 8. fig. 42.

Forma isthmo cellularum breviore et sinu minore, processibus cum undulis numerosioribus; cellulis tortis.

Long. (max.) 15–25 μ; lat. s. proc. circ. 7–8·5 μ; c. proc. 34–47 μ; lat. isthm. 4–5 μ; crass. 5·5 μ. (Pl. **6**. figs. 19–20.)

Hab. Yan Yean Reservoir, in the plankton and at the weedy margins; very common in the plankton, Jan. and Feb. 1906; abundant among the weeds, Mar., Nov., and Dec. 1905.

The specimens were almost invariably twisted at the isthmus, and the processes showed much variation in length. The species bears a considerable resemblance to *S. tetracerum*, Ralfs, but the broad excavation at the apex of each semicell and the more horizontally disposed processes easily distinguish it.

51. STAURASTRUM HARDYI, sp. n. (Pl. **6**. figs. 21–22.)

S. parvum, pæne duplo latius quam longum cum processibus, modice constrictum; semicellulæ subcampanulatæ (vel incudiformes e basi subangusta), parte basali subcylindrica et angulis basalibus leviter rotundatis, apice leviter triundulato, angulis superioribus in processus longos attenuatos horizontaliter dispositos productis, marginibus processuum nodulosis, apicibus processuum minute tridenticulatis; a vertice visæ fusiformes, corpore elliptico, polis in processus sublongos rectos attenuatos gradatim productis, marginibus processuum undulatis; membrana glabra.

Long. 21–24 μ; lat. c. proc. 39–43 μ; lat. isthm. 5–5·5 μ; crass. 9–9·5 μ.

Hab. Yan Yean Reservoir, at the weedy margins (July, Nov., and Dec. 1905; Jan. 1906).

This small species, which occurred abundantly in November and December, appears at first sight to have no very distinctive peculiarities. It is most nearly related to *Staurastrum undulatum*, W. & G. S. West (in Trans. Linn. Soc. ser. 2, Bot. v. (1895) p. 78, t. 8. fig. 37), and *S. exile*, W. & G. S. West (*l. c.* fig. 38), two species described from Madagascar, but is larger than either of them, with more finely nodulose processes, a more expanded apical region of the semicells, and a fusiform vertical view.

S. Hardyi was also frequent in a lagoon of the Yarra-Yarra River (Mar. 1905).

52. STAURASTRUM ASSURGENS, *Nordst. in K. Sv. Vet.-Akad. Handl.* Bd. xxii. no. 8 (1888), p. 37, t. 4. fig. 8.

Var. VICTORIENSE, var. n. (Pl. **6**. fig. 17.)

Var. minus, verrucis dorsalibus majoribus prominentioribusque; semicellulis a vertice visis angustioribus, sine tumore utrobique.

Long. 35–37 μ; lat. cum proc. 75–80 μ; lat. isthm. 7·5–8·5 μ; crass. 16·5 μ.

Hab. Yan Yean Reservoir, somewhat rare in the plankton, but abundant at the weedy margins (1905–6).

A curious monstrosity of this variety was observed which possessed four "semicells" united at a central point. Each "semicell" was quite normal in character, and the monstrosity is unique. The specimen was fully grown and I can offer no suggestion as to its origin unless it represents an abnormal growth from a zygospore. It would appear impossible for *cell-division* in the Desmidiaceæ to give rise to such a monstrosity.

—— —— Forma major; processibus elongatis et patentioribus.

Long. 57 μ; lat. c. proc. 148–160 μ. (Pl. **6**. fig. 18.)

Only two specimens of this large form were seen amongst a multitude of smaller ones.

It should be mentioned here that Playfair (Proc. Linn. Soc. N. S. Wales, xxxii. (1907) p. 192) has expressed some extraordinary views about "young forms" of *S assurgens* which are contrary to all known facts concerning the Desmidiaceæ.

53. STAURASTRUM INDENTATUM, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* vi. (1902) p. 186, t. 22. figs. 10–12.

Forma dorso semicellularum minus dentato; semicellula a vertice visa paullo angustiore.

Long. 38–41 μ; lat. c. proc. 65–73 μ; lat. isthm. 8–9·5 μ; crass. 12 μ.

Hab. Yan Yean Reservoir, in the plankton and at the weedy margins (1905).

This species was originally described from Ceylon, and the Australian specimens only differ in the less prominent denticulate warts at the apices of the semicells, and in the less inflated body of the semicell as seen in vertical view. Playfair has expressed the opinion that *Staurastrum indentatum* is an "immature form" of *S. assurgens*, Nordst., but he does not appear to have recognized the fundamental differences between these species.

54. STAURASTRUM LONGIRADIATUM, *W. & G. S. West, in Trans. Linn. Soc.* ser. 2, *Bot.* v. (1896) p. 267, t. 17. fig. 23.

Var. SUBNUDUM, var. n. (Pl. **6**. fig. 23.)

Var. parte basali semicellulæ leviter subrectangulari, apice sine verrucis emarginatis et levissime concavo, apicibus processuum subtrifurcatis; semicellulis a vertice visis fusiformibus, corpore elliptico.

Long. 30–31 μ; lat. c. proc. 68–76 μ; lat. isthm. 6·5–8 μ; crass. 11 μ.

Hab. Yan Yean Reservoir, at the weedy margins (Nov. and Dec. 1905, and Jan. 1906).

This variety occurred abundantly in Dec. 1905, and also occurred in the collections made in the preceding and following months. The type form of the species was never so abundant, but at the same time it was found in the material from April 1905 to Jan. 1906, and occurred in plenty in the plankton throughout the greater part of the year.

55. STAURASTRUM ZONATUM, *Börges. in Vidensk. Medd. Naturh. Foren. Kjöbenhavn* (1890), p. 46, t. 5. fig. 48.

Long. s. proc. 34 μ, c. proc. 42–44 μ; lat. c. proc. 48–56 μ; lat. isthm. 10 μ.

Hab. Pool in the Yan Yean catchment area, frequent (Sept. 1907). Previously known from Brazil, and a variety of it from Ceylon.

Genus SPHÆROZOSMA, *Corda.*

56. SPHÆROZOSMA WALLICHII, *Jacobsen, in Botan. Tidsskrift*, viii. (1876) p. 211.

Forma AUSTRALIS, f. n. (Pl. **3**. fig. 3.)

Forma duplo-minor, lateribus semicellulæ rectis et parallelis cum denticulis prominentibus tribus.

Long. 8 μ; lat. c. dentic. 8·5 μ; lat. isthm. 4 μ.

Hab. Yan Yean Reservoir, at the weedy margins, very rare (July 1905).

In this form the lateral margins of the semicells are quite straight and furnished with three denticulations, one at each angle and one in an intermediate position.

Order PROTOCOCCOIDEÆ.

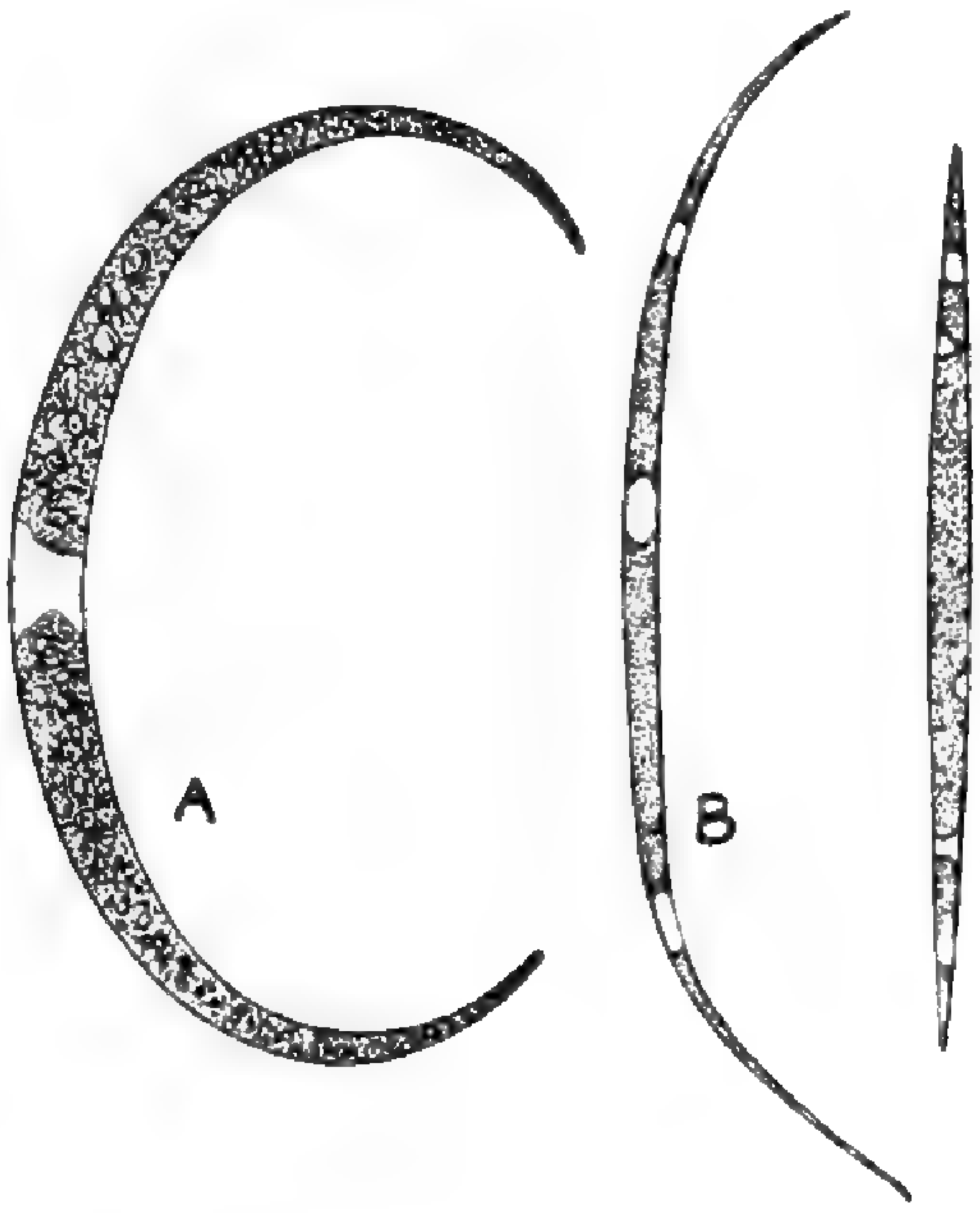
Family **PROTOCOCCACEÆ** (or **AUTOSPORACEÆ**).

Genus ANKISTRODESMUS, *Corda*.

57. Ankistrodesmus falcatus, (*Corda*) *Ralfs, Brit. Desm.* (1848) p. 180, t. 34. fig. 3 ; *G. S. West, Treatise Brit. Freshw. Alg.* 1904, p. 221.

Two curious forms of this plant were observed. One, from the May weed-collections of the Yan Yean Reservoir (1905), was strongly arcuate with incurved extremities : lat. 7 μ ; long. max. 94 μ ; apic. inter se distantibus 68 μ. (Text-fig. 8, A.)

Fig. 8.



A and B. Two forms of *Ankistrodesmus falcatus*, (Corda) Ralfs ; C. *A. falcatus* var. *acicularis*, (A. Br.) G. S. West. All × 500. B and C show fragmentation of the chloroplast.

The other form was almost straight in the middle, but strongly incurved at the extremities, which were much attenuated. The chloroplast was divided into four segments : long. 116 μ ; lat. 3·2 μ. (Text-fig. 8, B.)

Genus LAGERHEIMIA, *Chodat*.

58. Lagerheimia splendens, sp. n. (Pl. 6. figs. 4–8.)

L. conspicua et solitaria ; cellulæ cylindricæ cum polis obtuse conicis ; setis sublongis, rectis vel curvatis, 3–4 juxta sed infra polum unumquemque, tuberculis expansis et conspicuis ad basin setarum ; membrana cellularum sparse et levissime spirostriolata ; chromatophora singula parietali, sine pyrenoide (?).

Long. cell. 28–38 μ ; lat. cell. 7·5–9 μ ; long. set. 13–26 μ.

Hab. Yan Yean Reservoir, in the plankton (Feb. 1906, scarce).

This large and conspicuous *Lagerheimia* possesses cells which are almost three times the size of those of any other species. The outward form of the cells, with conical poles, is also quite distinctive. The bristles are most distinctly tuberculated at the base, the flattened tubercles being closely applied to the sloping sides of the poles and never at the extreme apex. The number of bristles attached to each pole is either three or four, and not uncommonly three are present at one pole and four at the other pole of the same individual. The bristles are readily detached from the cells, the tuberculated base leaving a minute scar on the conical pole from which it has become detached. The cell-wall is delicately marked with a few decussating spiral striations, which can be seen very well in some of the empty cells. There is a single parietal chloroplast, which only covers part of the wall of the cell, and, so far as could be ascertained, it contained no pyrenoids.

Genus OOCYSTIS, *Näg.*

59. Oocystis submarina, *Lagerh. in Botan. Notiser* (1886), p. 45, fig. 1.

Forma major : long. cell. 23–25 μ ; lat. cell. 7·5–8 μ.

Hab. Yan Yean Reservoir, at the weedy margins (Mar. 1905).

O. submarina was described by Lagerheim from brackish ditches in Sweden. In the form of the cells the Australian plant exactly agrees with it, but the dimensions are larger. The colonies observed consisted of either two or four cells.

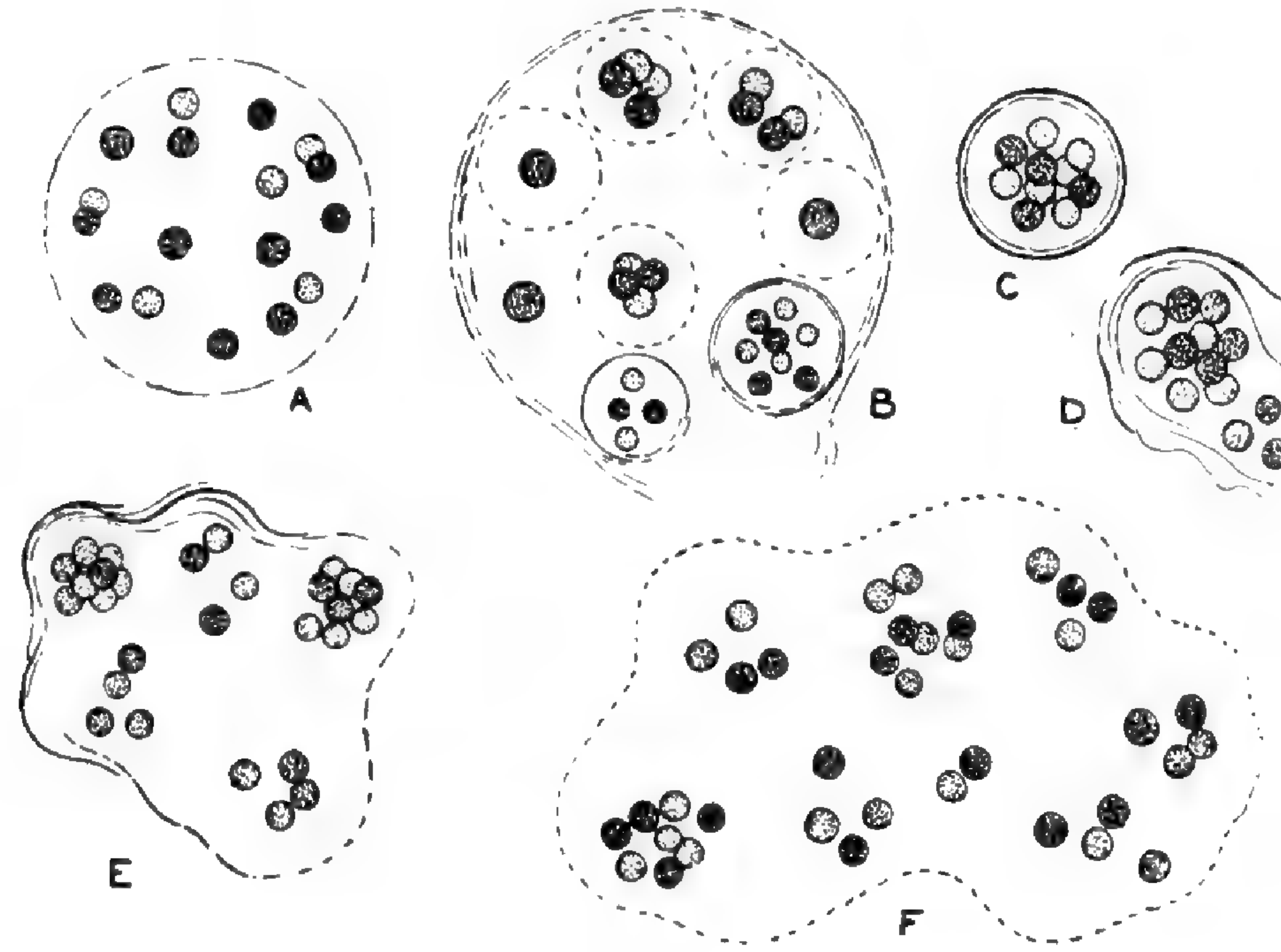
Family **PALMELLACEÆ.**

Genus TETRASPORA, *Link.*

60. Tetraspora lacustris, *Lemm. in Botan. Centralbl.* (1898) lxxvi. ; *in Forschungsber. Biol. Stat. Plön*, vii. (1899) p. 23, t. 1. fig. 13.

I have for some time regarded *Tetraspora lacustris*, Lemm., as most probably merely a stage in the life-history of *Sphærocystis Schröteri*, Chodat (*vide* Treat. Brit. Freshw. Alg. 1904, p. 242), and the Yan Yean plankton-collections furnish much evidence in support of this view. From February to September the plankton contained colonies of a green Alga which is unquestionably referable to *Sphærocystis Schroeteri*. These colonies reached their maximum abundance from June to July, and best exhibited the characteristic features of *Sphærocystis* from May to June. In July the larger colonies became mostly dissociated into the component smaller groups, which then developed more conspicuous gelatinous coats with much firmer outer envelopes. In September many of these small colonies became irregular, and in October all of them were irregular and a considerable range in size was evident. The investments of the larger colonies, which reached a diameter of 200 μ, were very gelatinous and inconspicuous. Among these larger colonies were colonies of an intermediate size, which could be seen clearly arising by further cell-division from the small groups with tough envelopes. This growth was accompanied by the extension of the inner, more gelatinous coats of mucus, as the outer, firmer coats were exfoliated. The second, irregular type of colony was abundant from October to December, reaching its maximum abundance in November, and it appears to me that it must be regarded as identical with the Alga described by Lemmermann as *Tetraspora lacustris*.

Fig. 9.



A—F. Stages in the life-history of *Sphærocystis Schroeteri* as seen in the plankton of the Yan Yean Reservoir. ×300.

A and B, typical *Sphærocystis*-stage; C, group of daughter-cells escaped from larger colony; D, growth of colony C by exfoliation of tougher outer membranes; E, further advanced; F, *Tetraspora*-stage.

The different colonies described above are stages in the life-history of one Alga, the *Sphærocystis*-type of colony flourishing from February to August, and then giving rise to the imperfect *Tetraspora*-type, which is abundant from September to December. No trace of the Alga was observed in the January collections.

Class **BACILLARIEÆ.**

Order CENTRICÆ.

Family **RHIZOSOLENIACEÆ.**

Genus RHIZOSOLENIA, *Ehrenb.*

61. Rhizosolenia morsa, *W. & G. S. West, in Trans. Roy. Irish Acad.* xxxiii. sect. B (1906), p. 109, t. 11. figs. 5–7.—R. eriensis, *H. L. Smith*, var. morsa, *W. & G. S. West, in Trans. Roy. Soc. Edin.* xli. part iii. (1905) p. 509, t. 6. fig. 23.

Lat. valv. 5–9 μ; long. set. 18–22 μ. (Pl. **3**. figs. 15–16.)

Hab. Yan Yean Reservoir, in the plankton (Jan. 1906).

This Diatom was not uncommon in the January plankton, but no trace of it was observed in any of the other collections. It thus appears in the plankton only when the temperature of the surface water is at its highest (74° F. = 23·3° C.). In the possession of the peculiar excavated extremities the specimens exactly agreed with those which occur in the summer plankton of the lakes of the western British area, but they were all proportionately smaller with shorter bristles.

It is probable that the vegetative period of *R. morsa* lasts only for about five or six weeks in the warmest part of the year, and as I have never yet seen a single individual except from a purely limnetic habitat, the vegetative phase appears to be confined to the plankton. At its conclusion, resting-spores are formed, which presumably remain dormant for an extended period until the requisite conditions for germination again supervene, but practically nothing is known concerning the resting-spores during the lengthy period they appear to be quiescent.

Order PENNATÆ.

Family **EUNOTIACEÆ.**

Genus EUNOTIA, *Ehrenb.*

62. Eunotia major, (*W. Sm.*) *Rabenh.*, var. bidens, (*Greg.*); *Van Heurck, Synops. Diat. Belg.* t. 34. fig. 15.—Himantidium bidens, *Greg.*

This Diatom was very common among the Yan Yean weeds, and the valves exhibited a great variability of size. Some of the tiny specimens were only 36 μ in length, whereas the largest reached a length of 158 μ, a much more normal size for forms of *Eunotia major.*

One form was noticed with four undulations instead of the two wide ones on the dorsal margin. As this feature at once marks it off from all the biundulate forms, it might stand as forma *quadriundulata*. Long. 88 μ; lat. med. 12 μ; lat. apic. 8·5 μ.

63. Eunotia crispula, sp. n. (Pl. **3**. fig. 14.)

E. submediocris, cellula ut in visa aspectu valvulari subelongatis et levissime curvatis, polis subangustis sed rotundatis, margine ventrali et dorsali valde undulato-noduloso, nodulis dorsalibus iis ventralibus alternantibus; striis validis, 8 in 10 μ; nodulis terminalibus conspicuis; in aspectu cingulato rectangulari, lateribus levissime et latissime biundulatis.

Long. 41–112 μ; lat. 11–12·5 μ; lat. pol. 5–6·5 μ.

Hab. Yan Yean Reservoir, at the weedy margins (Mar. and June, 1905).

This species of *Eunotia* is very characteristic, and I can find no published record of one which agrees with it. The crinkled nature of the valves, with the alternating nodulations of the dorsal and ventral margins, and the comparatively slight curvature, are its distinguishing features. The apices are somewhat narrow, but rounded and exactly equal, and the terminal nodule is ventral and conspicuous. The striations are rather coarse and very distinct. The individuals varied much in length and consequently in the number of nodulations. According to the length there are from 3 to 7 nodulations on the dorsal margin and from 2 to 7 on the ventral margin. In the more elongated individuals both margins possess an equal number of nodulations, but in the shortest forms there are three dorsal and only two ventral nodulations. In the girdle-view the cell is rectangular and the longer margins of the valve are very slightly biundulate.

The nodulation of *Eunotia crispula* reminds one very much of *Actinella mirabilis,* Grun., but the extremities of the valves are not asymmetrical, and the cells are not united to form colonies as in *Actinella* and *Desmagonium.*

E. crispula was also frequent in some collections made by Mr. Hardy at Heidelberg, Victoria (Mar. 1905).

Family **NAVICULACEÆ.**

Genus NAVICULA, *Ehrenb.*

64. Navicula bicapitata, *Lagerstedt, Spitsberg. Diat.* p. 23, t. 1. fig. 5; *Van Heurck, Synops. Diat. Belg.* p. 78, t. 6. fig. 14.

A form identical with *Pinnularia interrupta*, W. Sm. (1853), forma *biceps*, (Greg.) Cleve, Synops. Navic. Diat. ii. (1895) p. 76 (= *N. biceps*, Greg., 1856; *P. interrupta β*, W. Sm. Brit. Diat. ii. p. 96). (Pl. **3**. fig. 13.)

This Diatom occurred in considerable abundance both in the plankton and among the weeds at the lake-margin. The extremities are less capitate than in

Lagerstedt's Spitsbergen specimens of *Navicula bicapitata*, but are distinctly produced and slightly dilated. There is a clear space of considerable width on each side of the raphe, owing to the shortness of the striæ, and in the middle opposite the central nodule this clear area widens still further. The striæ do not cease, however, in the median part of the valve; they strongly converge towards both the central and terminal nodules, and are about 9–10 in 10 μ.

In outline this form agrees fairly closely with *Pinnularia microstauron*, Cleve, Synops. Navic. Diat. ii. 1895, p. 77 (= *N. bicapitata* var. *hybrida*, Grun.; *cf.* Van Heurck, *l. c.* t. 6. fig. 9), but the striæ do not cease in the middle. It is also very near *Navicula subcapitata*, Greg., especially in the less capitate poles, but as the striæ do not stop on each side of the middle, and the poles are distinctly angular, I have regarded it as more nearly approaching *N. bicapitata.* In outline it bears much resemblance to *N. kefvingensis*, Ehrenb., from Jaaling, figured in Schmidt's Atlas Diat. t. 47. fig. 63, but the extremities are not quite so narrowed and the striæ do not reach so close to the raphe.

Perhaps the form seen so abundantly from Australia should be regarded as *Pinnularia microstauron*, (Ehrenb.) Cleve, but it seems almost impossible to demarcate between *P. interrupta*, *P. mesolepta*, *P. microstauron*, *N. bicapitata*, and *N. subcapitata*, as their numerous forms constitute a continuous series. The Australian forms agree more closely with the published figures of *N. bicapitata* than with any other, and I have for the present adopted that name.

Genus GYROSIGMA, *Hass.*

65. Gyrosigma elongatum, (*W. Sm.*) *nob.*, var. ?

Long. 362 μ; lat. med. 22 μ. (Pl. **3.** fig. 17.)

Hab. Yan Yean Reservoir, very scarce in the plankton (Nov. 1905).

This *Gyrosigma* differs very much from any other species I have observed in fresh water, and I can find no figure exactly corresponding to it in Peragallo's 'Monogr. Gen. *Pleurosigma*,' Le Diatomiste (1890–91). The nearest are "*P. decorum*, W. Sm., var. ? *americanum*, Per." (= *P. longum* Cleve, var. *americanum* (Per.), Cleve), and *P. elongatum*, W. Sm. (*vide* Peragallo, *l. c.* p. 5, t. 1. fig. 9, and p. 7, t. 3. fig. 5). The first of these is perhaps the nearest as regards outline and the position of the raphe, but the striæ are very delicate and oblique as in *P. elongatum.* The extremities of the valves are about as acute as those of *P. elongatum* (especially Peragallo's fig. 8 on t. 3), but the raphe is very decidedly oblique and not central. The Australian plant has also a more elongate median part of the valve, in which the margins are parallel for some distance, and the central nodule is likewise oblong-elliptic.

I have only observed five specimens of this interesting *Gyrosigma*, and if the examination of further individuals indicates that its characters are constant, it would perhaps be better to regard it as a new freshwater species. If Cleve's separation of the genera *Gyrosigma* and *Pleurosigma* be accepted (*cf.* Cleve, Synops. Navic. Diat. i. (1894) pp. 32 and 112), the Australian species would come under the latter genus; if his separation be not accepted, then it is a species of *Gyrosigma*.

Class **PERIDINEÆ.**

Order PERIDINIALES.

Family **PERIDINIACEÆ.**

Genus PERIDINIUM, *Ehrenb.*

66. PERIDINIUM VOLZII, *Lemm. in Abh. Nat. Ver. Brem.* xviii. (1904) p. 166, t. 11. figs. 15–18.

Var. AUSTRALE, var. n. (Text-fig. 10, A–G.)

Var. paullo major: hypovalva cum tabulis antapicalibus duobus *asymmetricis*; tabulis rhomboideis et tabulis apicalibus 4 epivalvæ cum iis formæ typicæ non plane congruentibus; fossa longitudinis ut visa ventrali sine spira minuta terminali.

Long. 40–56 μ; lat. 39–59 μ.

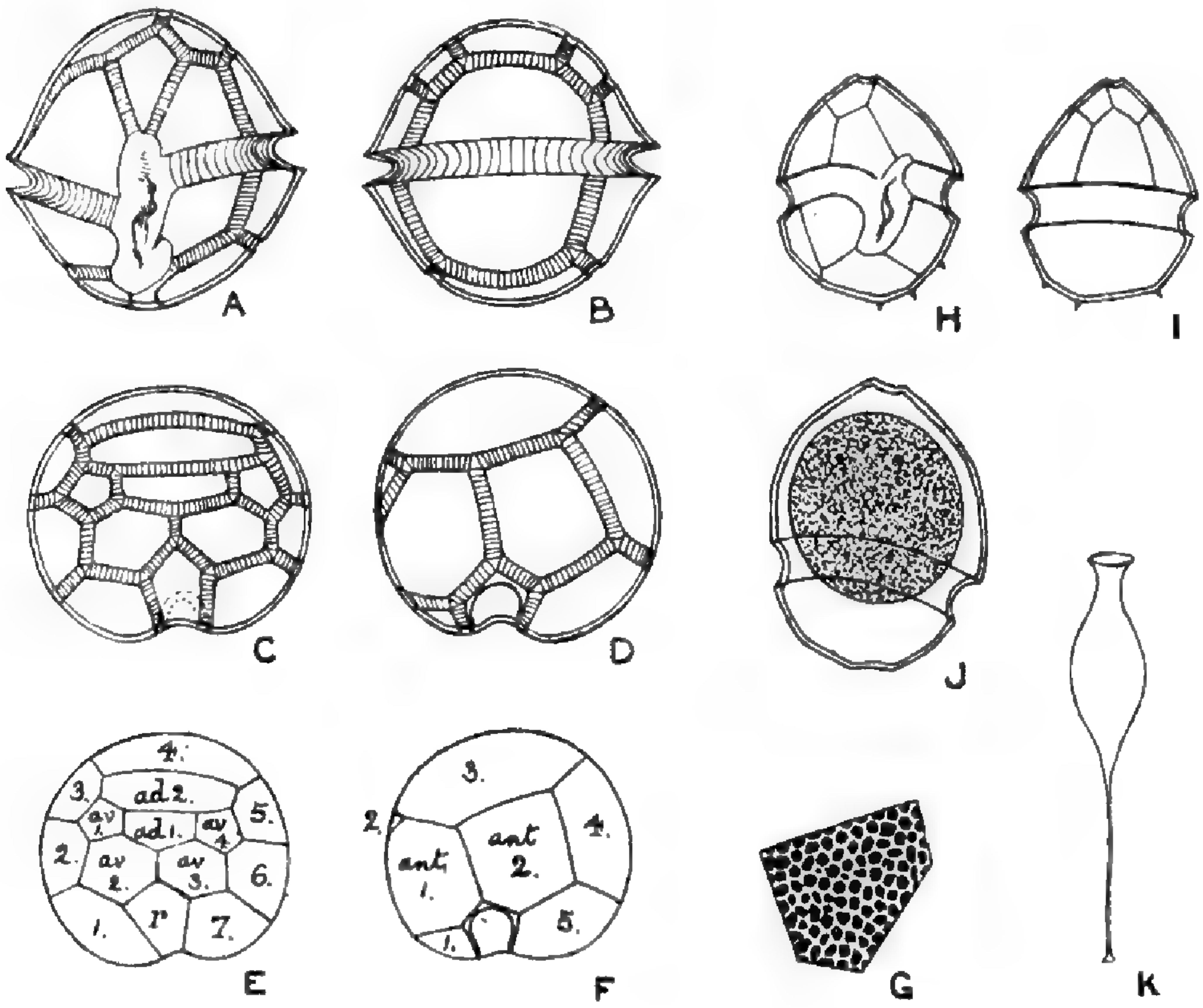
Hab. Yan Yean Reservoir, in the plankton (mostly from Nov. 1905 to Feb. 1906) and at the weedy margins (May and Dec. 1905).

The general disposition of the plates composing the cell-wall is very similar to the arrangement in a species of *Peridinium* recently found at Singapore, and described by Lemmermann as *P. Volzii.* There are, however, certain differences in the shape of the four apical plates and the two dorsal plates, and in the asymmetrical disposition of the two antapical plates, not to mention a few other minor distinctions.

Mr. Lemmermann very kindly examined both specimens and drawings of the Australian form, and as he regards it as somewhat different from the organism he recorded from Singapore, I have described it as a variety of that species.

The most interesting feature exhibited by *P. Volzii* var. *australe* is the asymmetrical disposition of the two antapical plates, as such a character leads one to suspect that the Australian form is one of the connecting links between the two genera *Peridinium* and *Gonyaulax*. In the latter genus the hypovalve possesses one central antapical plate and an occasional plate, and it is quite conceivable that by a further slight rotation of the two antapical plates of *P. Volzii* var. *australe,* until one of them attained a central position, a condition corresponding to that which obtains in *Gonyaulax* may easily have been produced. It is therefore quite possible that the genus *Gonyaulax* *, the species of which are neither so numerous nor so widely distributed as those of *Peridinium*, has had a direct origin from the latter genus.

Fig. 10.



A–G. *Peridinium Volzii*, Lemm., var. ***australe***, var. n. A, ventral view; B, dorsal view; C, epivalve; D, hypovalve. E, outline of epivalve with the various plates named:—1–7, præ-equatorial plates; *ad.* 1 and *ad.* 2, dorsal apical plates; *av.* 1–*av.* 4, ventral apical plates; *r*, rhomboidal plate. F, outline of hypovalve to show plates:—1–5, post-equatorial plates; *ant.* 1 and *ant.* 2, obliquely disposed antapical plates. A–F, × 500. G, single plate to show areolations, × 1000.

H–J. *Peridinium inconspicuum*, Lemm., × 1000. J, old cell-wall containing a cyst.

K. *Dinobryon elegantissimum*, sp. n., × 500.

67. PERIDINIUM INCONSPICUUM, *Lemm. in Abh. Nat. Ver. Bremen*, xvi. (1902) p. 350; *in Engler, Bot. Jahrb.* xxxiv. (1905) t. 8. fig. 1.

Long. 17–18 μ; lat. 13·5–15 μ; diam. cyst. 13·5–15·5 μ. (Text-fig. 10, H–J.)

Hab. Yan Yean Reservoir, at the weedy margins (Nov. 1905–Jan. 1906).

This minute species was very abundant in December 1905, in which month a few resting cysts were formed. These were ovoid-globose, with smooth walls, and a little smaller than the somewhat distended wall of the mother-cell.

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* The genus *Gonyaulax* has been recently revised by Lemmermann in Botan. Centralbl. xxi. (1907) pp. 296–300.

Class **FLAGELLATA.**

Family **DINOBRYACEÆ.**

Genus DINOBRYON, *Ehrenb.*

68. DINOBRYON ELEGANTISSIMUM, sp. n. (Text-fig. 10, K.)

Membrana evacuata firma et hyalina; parte mediana ellipsoidea, parte superiore producta et angustiore, colliformi cum osculo expanso ad apicem, parte inferiore acute conica et in stipitem tenuem elongatum producta, cum basin stipitis expansa.

Long. (sine stip.) 34 μ; long. stip. 28 μ; lat. max. 13 μ; lat. coll. 4 μ; lat. oscul. 7·5 μ.

Hab. Yan Yean Reservoir, at the weedy margin (Jan. 1906); very rare.

Only two empty tests of this species were observed. It is distinguished by its elegance of outline, by its rather narrow neck with an expanded mouth, and by its elongated stalk. The stalk possesses a slight basal disc for attachment, from which one would conclude that the individuals are solitary. In the two specimens seen no traces of the cell-contents were present, and for this reason I am rather doubtful about the correct inclusion of this organism in the genus *Dinobryon*.

VI. THE PECULIARITIES OF THE AUSTRALASIAN ALGA-FLORA.

As I have previously pointed out*, no group of the freshwater Algæ exhibits such marked geographical peculiarities as the Desmidiaceæ. Some of the subaerial Algæ, such as many species of *Trentepohlia*, *Cephaleuros*, *Phyllosiphon*, of the Scytonemaceæ, Nostocaceæ, etc., are restricted to certain regions, but, apart from indefinite limitations to tropical or temperate zones, their distribution is rather a question of atmospheric conditions than of geographical situation. Most of the Oedogoniaceæ, Ulotrichaceæ, Cladophoraceæ, Zygnemaceæ, and Protococcaceæ are more or less world-wide as either temperate or tropical species, or as both; and there is no reason to suppose that the new species of these groups described in the present paper (*Ulothrix idiospora*, *Debarya Hardyi*, *Mougeotia victoriensis*, etc.) are restricted to Australia. It is more than probable that they will be found in New Zealand, in various islands of the Pacific, in the East Indian Archipelago, and parts of Eastern Asia, and not unlikely in Central and South Africa and South America.

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* G. S. West in Journ. Linn. Soc., Bot. xxxviii. (1907) p. 82; W. & G. S. West in Ann. Roy. Bot. Gard. Calcutta, vol. vi. (1907) p. 176.

The Yan Yean collections were fairly rich in the Desmidiaceæ, and it is this group which must be examined for the peculiarities which enable one to recognise from what part of the world the collections were obtained without having previously been informed. Even with our present imperfect knowledge, one can almost invariably do this with a rich Desmid collection. On contrasting Nordstedt's valuable contribution to the freshwater Algæ of New Zealand * with the present paper, it is at once obvious that Australia and New Zealand have much in common amongst the Desmids, including many species which are only known to occur in this region. In the Yan Yean collections the Australasian types were the following:—

Pleurotænium mamillatum, G. S. West.
Micrasterias Hardyi, G. S. West.
Cosmarium Capitulum, Roy & Biss., var. *australe*, G. S. West.
 ,, *perfissum*, G. S. West.
 ,, *achondroides*, G. S. West.
 ,, *dorsitruncatum*, (Nordst.) G. S. West.
 ,, *Murrayi*, Playfair.
 ,, *turgidum*, Bréb., var. *ovatum*, Nordst.
 ,, *amplum*, Nordst.
 ,, *Hardyi*, G. S. West.
 ,, *amœnum*, Bréb., var. *mediolæve*, Nordst.
Staurastrum assurgens, Nordst.
 ,, *sagittarium*, Nordst.
 ,, *victoriense*, G. S. West.
 ,, *digitatum*, G. S. West.
 ,, *sexangulare*, (Buln.) Rabenh., var. *productum*, Nordst.

The following species, although not observed in the Yan Yean drainage area, are also Australasian types so far as can be judged from our present knowledge:—

Euastrum multigibberum, Nordst.
Micrasterias suboblonga, Nordst.
Cosmarium securiforme, Borge.
Xanthidium bifurcum, Borge.
 ,, *gloriosum*, G. S. West (=*X. pulcherrimum*, Playfair).
 ,, *multicorne*, Borge.
Staurastrum cruciforme, Playfair.
 ,, *elegans*, Borge.
Hyalotheca hians, Nordst.

The Australian Desmid-flora is a rich one, probably far richer than that of

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* O. Nordstedt in Kongl. Sv. Vet.-Akad. Handl. xxii. no. 8 (1888).

Europe, and even as far south as Victoria it is largely tropical in character. It includes a number of species which are general in the Indo-Malayan region, amongst which may be mentioned:—*Pleurotænium Kayei*, (Arch.) Rabenh.; *Triploceras gracile*, Bail., and varieties *; *Euastrum longicolle*, Nordst.; *E. rostratum*, Ralfs, var. *præmorsum*, Nordst.; *Micrasterias Möbii*, W. & G. S. West; *Cosmarium Askenasyi*, Schmidle; *C. tjibenongense*, Gutw.; *Staurastrum unicorne*, W. B. Turn., and varieties; *S. patens*, W. B. Turn., and varieties; and *S. indentatum*, W. & G. S. West. It appears as though the Australian Desmid-flora had a good sprinkling of tropical Indo-Malayan species, even such a common tropical species as *Staurastrum unicorne* in the Indian region extending as far south as Victoria.

A few African and Malagasy species occur, such as forms of *Cosmarium subtriordinatum*, W. & G. S. West; *Staurastrum excavatum*, W. & G. S. West; *S. bibrachiatum*, Reinsch, var. *cymatium*, W. & G. S. West †.

A few South American (Brazilian) species likewise exist in Australia, and others which are more closely allied to South American species than any other known forms. *Pleurotænium ovatum*, *Staurastrum leptacanthum*, *S. zonatum*, and *S. leptocladum* were originally described from Brazil, and *Staurastrum victoriense* is more nearly allied to the Brazilian *S. nudibrachiatum* than to any other known species.

VII. GENERAL SUMMARY.

1. *The* PHYTOPLANKTON *of the Yan Yean Reservoir, Victoria, is rich both in number of species and individuals. It reaches its greatest development in March and April*, although the greatest bulk of the plankton as a whole is in July, August, and September, when the Crustacea are dominant. *The phytoplankton is poorest in September and October*, in which months it is almost absent.

It does not contain many Flagellates, and remarkably few Myxophyceæ. The absence of the Blue-green element at all times of the year is one of its most noteworthy features.

The complete absence of *Ceratium Hirundinella* is also surprising, especially as this organism occurs in the plankton of the Toorourong Reservoir which supplies the greater part of the water to the Yan Yean.

It has a rich Desmid-flora, containing many characteristic Australasian types. The plankton for a great part of the year can be described as a "Desmid-plankton," and from February to April (or even May) it consists almost exclusively of these interesting and elegant Conjugates. In the richness of its Desmid-flora it compares very well with the lakes of the western British lake-areas. *The Yan Yean Reservoir furnishes another instance of a rich Desmid-plankton occurring in a lake situated on the Older Palæozoic formations and receiving the drainage from extensive outcrops of these old rocks.* A portion of the drainage, as is so often the case in mountainous, Older Palæozoic areas, is also derived from outcrops of igneous material.

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* *Triploceras gracile* exhibits more variation and abnormalities in the Australasian region than in any other part of the world.

† Bohlin has also recorded this species from the Azores.

In the complete absence of *Fragilaria* and *Asterionella*, and of the star-dispositions of the frustules of *Tabellaria*, the phytoplankton differs conspicuously from the European plankton, but agrees with the known plankton of the great African lakes.

In the plankton of the Yan Yean Reservoir there are three distinct phases:—

I. *Nov.–Jan.* (beginning of warm period).—*Melosira granulata* and *Dinobryon* are the chief constituents, together with a few of the Protococcoideæ (such as *Pediastrum duplex* var. *clathratum* and *Eudorina elegans*).

II. *Feb.–May* (warm period or summer phase).—Desmids dominant, with a little *Melosira granulata*.

III. *June–Oct.* (cold period).—Crustacea dominant; phytoplankton almost absent.

The summer phase of the plankton (from Feb. to May), which in most European and North American lakes is dominated by Blue-green Algæ, is here dominated by Desmids (as in many lakes of the British area) and by *Melosira granulata*. The latter is an exception to most of the freshwater Bacillarieæ in having its maximum in the warmest period of the year.

Out of 104 species and 16 varieties observed in the phytoplankton, 23 species and 5 varieties were exclusively confined to it, not having been seen from any other part of the entire drainage area.

2. The MICROPHYTIC BENTHOS or littoral Alga-flora of the Yan Yean Reservoir was richer in species than the phytoplankton and contained many interesting types. *Many species common to the plankton and the benthos attain first a maximum in the plankton and subsequently a maximum in the benthos,* the time which elapses between these two maxima varying from three to eight weeks.

There are three phases in the benthos during the year, but these are not so marked as the phases of the phytoplankton. They may be stated as follows:—

I. *Nov.–Jan.* (vernal rise of temperature).—Dominance of Oedogoniaceæ and Zygnemaceæ (mostly in the fruiting condition). Many Desmids present, and some species abundant. *Peridinium* and *Dinobryon* frequent.

II. *Feb.–July* (warm period or summer phase).—Desmids dominant. *Melosira granulata* and *Cocconeis Placentula* conspicuous.

III. *Sept.–Oct.* (cold period).—Very little Algal life, at any rate in the active vegetative condition. *Tabellaria flocculosa* and *Vanheurckia viridula* both noticeable.

3. Some light is thrown on the ORIGIN OF THE MICROPHYTIC BENTHOS AND OF THE PHYTOPLANKTON by the investigations carried out in other parts of the drainage area. *The upper dams* (Toorourong Reservoir, Wallaby Creek Weir, and Silver Creek Weir) *yield few plankton species* owing to the disturbed state of the water, but *their examination indicates that the Yan Yean Reservoir does not derive its numerous Algal constituents from these dams although receiving six-sevenths of its water-supply from them. The rich Alga-flora of the Yan Yean appears to be derived almost entirely from its own small catchment basin*, and along the two marshy inlets of Rana Creek and Ottelia Creek.

The phytoplankton is partially recruited from the microphytic benthos, and it also consists in part of well-established forms which are not recruited from the shore-regions. Some of these well-established plankton forms seemingly supply the benthos with recruits in greater or smaller numbers during the autumnal fall of temperature.

Some of the plankton species are not derived from the benthos, and neither do they appear to be acquired by the aqueduct which brings the chief water-supply from the large drainage area. As these species are in some cases dominant forms, they must have been established in the plankton for some time. Their actual origin is mostly a matter for future investigation.

4. *Over* 300 *species of Algæ were observed* in the complete collections *from the entire Yan Yean drainage area.* Of these, 14 *species and* 11 *varieties are here described for the first time*, and 4 species and 5 varieties which had previously been only partially described are here dealt with in greater detail, and for the first time figured.

University Botanical Laboratory, Birmingham,
April 1908.

EXPLANATION OF THE PLATES.

PLATE 1.

Photomicrographs of plankton from the Yan Yean Reservoir. Two upper photographs January and March; two lower photographs April. All × 100.

Figs. 1 & 2. *Pediastrum duplex* var. *reticulatum*; 3. *Scenedesmus bijugatus* forma *arcuata*; 4 & 5. *Melosira granulata*; 6. *Tabellaria flocculosa*; 7 & 8. *Dinobryon cylindricum* var. *divergens*; 9. *D. elongatum* var. *undulatum*.

10. *Micrasterias Hardyi*; 11. *Staurastrum leptacanthum*; 12 & 13. *S. corniculatum*;

14 & 15. *S. corniculatum* var. *spinigerum*; 16 & 17. *S. mucronatum* var. *delicatulum*; 18. *S. sexangulare*; 19. *Melosira granulata*; 20. *Cosmarium pseudoprotuberans* var. *angustius*; 21. *Closteriopsis longissima*.

Figs. 22 & 23. *Micrasterias Hardyi*; 24. *Staurastrum assurgens* var. *victoriense*; 25. *S. leptacanthum*; 26. *S. dejectum*; 27. *Cosmarium pseudoprotuberans* var. *angustius*; 28. *C. Capitulum* var. *australe*; 29. *Ankistrodesmus falcatus*; 30. *Melosira granulata*.

31 & 32. *Micrasterias Hardyi*; 33. Damaged semicell of *Cosmarium achondroides*; 34. *C. Hardyi*; 35. *C. Capitulum* var. *australe*; 36 & 37. *C. tortum* forma *trigona*; 38. *Staurastrum corniculatum*; 39. *S. assurgens* var. *victoriense*; 40. *S. paradoxum* var. *longipes*; 41. *S. cuspidatum*: 42. Old carapace of *Bosmina*, with quantities of decaying organic matter attached.

Note.—The dark, ill-defined patches in the March and April plankton consist of irregular masses of decaying organic matter.

PLATE 2.

Fig. 1. *Mougeotia victoriensis*, sp. n. × 500. Conjugating filaments showing two spores each surrounded by a wide mucous coat to which are attached numerous small particles of mineral matter.

Figs. 2-3. *Zygnema spontaneum*, Nordst. × 500. In fig. 3 one zygospore (*z*) is shown and two aplanospores (*apl.*).

4-5. *Mougeotia subcrassa*, sp. n. 4, × 200; 5, spore with portions of walls of attached cells, × 500.

6-11. *Debarya Hardyi*, sp. n. 6, × 500; early stage of conjugation, just after formation of conjugating-tube; 7-9, × 1000, extremities of emptying gametangia to show the internal thickening which is gradually laid down until they become solid. 10 & 11, two adult zygospores, × 500.

12-14. *Ulothrix idiospora*, sp. n. 12 & 13, two filaments showing vegetative cells and adult akinetes (*apl.*), 500. × *chl.*, chloroplast; *py.*, pyrenoid. 14, akinete to show scrobiculation of wall, × 1000.

15. *Ceratium Hirundinella*, O. F. Müll. × 200. A form from the plankton of the Toorourong Reservoir showing an inward curvature of the third antapical horn (*a*).

PLATE 3.

Figs. 1-2. *Pleurotænium mamillatum*, G. S. West. 1, × 520; 2, × 430.

3. *Sphærozosma Wallichii*, Jacobs., forma *australis*. × 840.

4-5. *Triploceras gracile*, Bail., var. *robustum*, var. n. × 500. 5, side view of another apex.

6-7. *Triploceras gracile*, Bail., var. *aculeatum*, Nordst., forma. × 500. 7, side view of apical region.

8-10. *Triploceras gracile*, Bail., var. *denticulatum*, (Playfair) nob. × 500. Fig. 9 shows side view of apical region.

11. *Staurastrum unicorne*, W. B. Turn., var. *nodiferum*, (W. B. Turn.) W. & G. S. West. A form, × 840.

12. *Staurastrum neglectum*, sp. n. *a* and *b*, × 500; *b'*, × 840.

13. *Navicula bicapitata*, Lagerstedt. × 840.

14. *Eunotia crispula*, sp. n. × 500.

15-16. *Rhizosolenia morsa*, W. & G. S. West. × 840.

17. *Gyrosigma elongatum*, (W. Sm.) nob., var.? × 500.

PLATE 4.

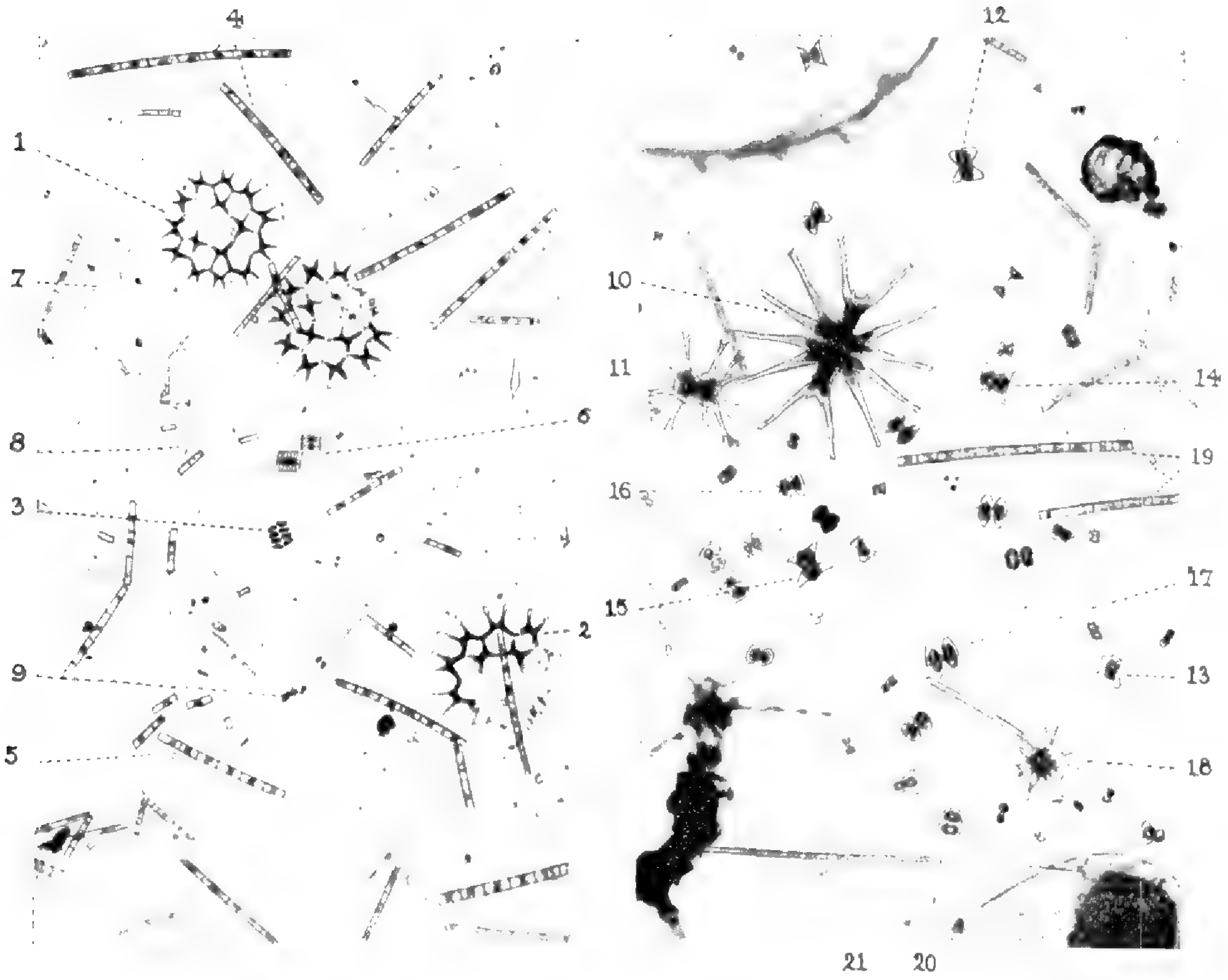
Fig. 1. *Micrasterias Thomasiana*, Arch., var. *pulcherrima*, var. n. × 350.
2. *Cosmarium perfissum*, sp. n. *a* and *b*, × 500; *a′*, × 840.
3. ,, *tjibenongense*, Gutw., forma. × 500.
4. ,, *dorsitruncatum*, (Nordst.) nob. 500.
5. ,, *Murrayi*, Playfair. *a*, × 1000; *b* and *c*, × 840.
6. ,, *subtriordinatum*, W. & G. S. West, forma. × 840.
7. ,, *Phaseolus*, Bréb., forma. × 500.
8. ,, *Hardyi*, G. S. West. × 430.
9–10. ,, *achondroides*, sp. n. × 500.
11. ,, *trachypleurum*, Lund., var. *subglabrum*, var. n. × 500.
12. ,, *quadratulum*, (Gay) De Toni. × 1000.

PLATE 5.

Figs. 1–2. *Micrasterias Hardyi*, G. S. West. × 500. 2, basal view of semicell.
3–4. *Cosmarium tortum*, Lagerh. & Nordst., forma *trigona*, G. S. West. × 430.
5. *Staurastrum mucronatum*, Ralfs, var. *delicatulum*, G. S. West. × 430.
6. *Cosmarium Capitulum*, Roy & Biss., var. *australe*, G. S. West. *a*, × 520; *a′* and *b*, × 430.
7. *Cosmarium affine*, Racib., var. *excavatum*, var. n. × 840.
8. *Staurastrum muticum*, Bréb., var. *victoriense*, G. S. West. × 430.
9. *Cosmarium goniodes*, W. & G. S. West, var. *subturgidum*, W. & G. S. West. × 840.
10. *Staurastrum lævispinum*, Biss., var. *subbrachiatum*, G. S. West. × 430.
11–12. *Staurastrum digitatum*, sp. n. × 500. 11, four-rayed specimen; 12, five-rayed specimen.
13–15. *Staurastrum victoriense*, sp. n. × 500.
16. *Cosmarium moniliforme*, (Turp.) Ralfs, var. *limneticum*, W. & G. S. West. × 500.

PLATE 6.

Figs. 1–3. *Radiofilum conjunctivum*, Schmidle. × 1000. Fig. 2 is the apex of a filament to show the rounded apical cell. Fig. 3 shows a curious branched condition. *chl.*, parietal, cup-shaped chloroplast.
4–8. *Lagerheimia splendens*, sp. n. 4–6, × 500; 7 & 8, × 840. Figs. 5 & 8 show the parietal chloroplast (*chl.*).
9. Zygospore of *Pleurotænium ovatum*, Nordst., var. *tumidum*, Mask. × 220. The inner and middle coats have shrunk away from the outer coat, and the middle coat is externally papillate.
10–12. *Staurastrum striolatum*, (Näg.) Arch. 10 & 11, × 550; 12, × 500. Fig. 10, front view of zygospore with attached semicells; fig. 11, zygospore seen from the side; fig. 12, empty vegetative cell.
13. *Staurastrum senarium*, (Ehrenb.) Ralfs. × 500.
14. ,, *patens*, W. B. Turn., var. *planctonicum*, G. S. West. × 520.
15–16. ,, *bibrachiatum*, Reinsch, var. *cymatium*, W. & G. S. West. × 500. Fig. 15 shows an abnormal lower semicell almost identical in character with a semicell of *S. tetracerum*, Ralfs.
17. *Staurastrum assurgens*, Nordst., var. *victoriense*, var. n. × 430.
18. Very large form of preceding variety, × 500.
19–20. *Staurastrum excavatum*, W. & G. S. West, forma. × 500.
21–22. ,, *Hardyi*, sp. n. 21, × 840; 22, × 650.
23. ,, *longiradiatum*, W. & G. S. West, var. *subnudum*, var. n. × 500.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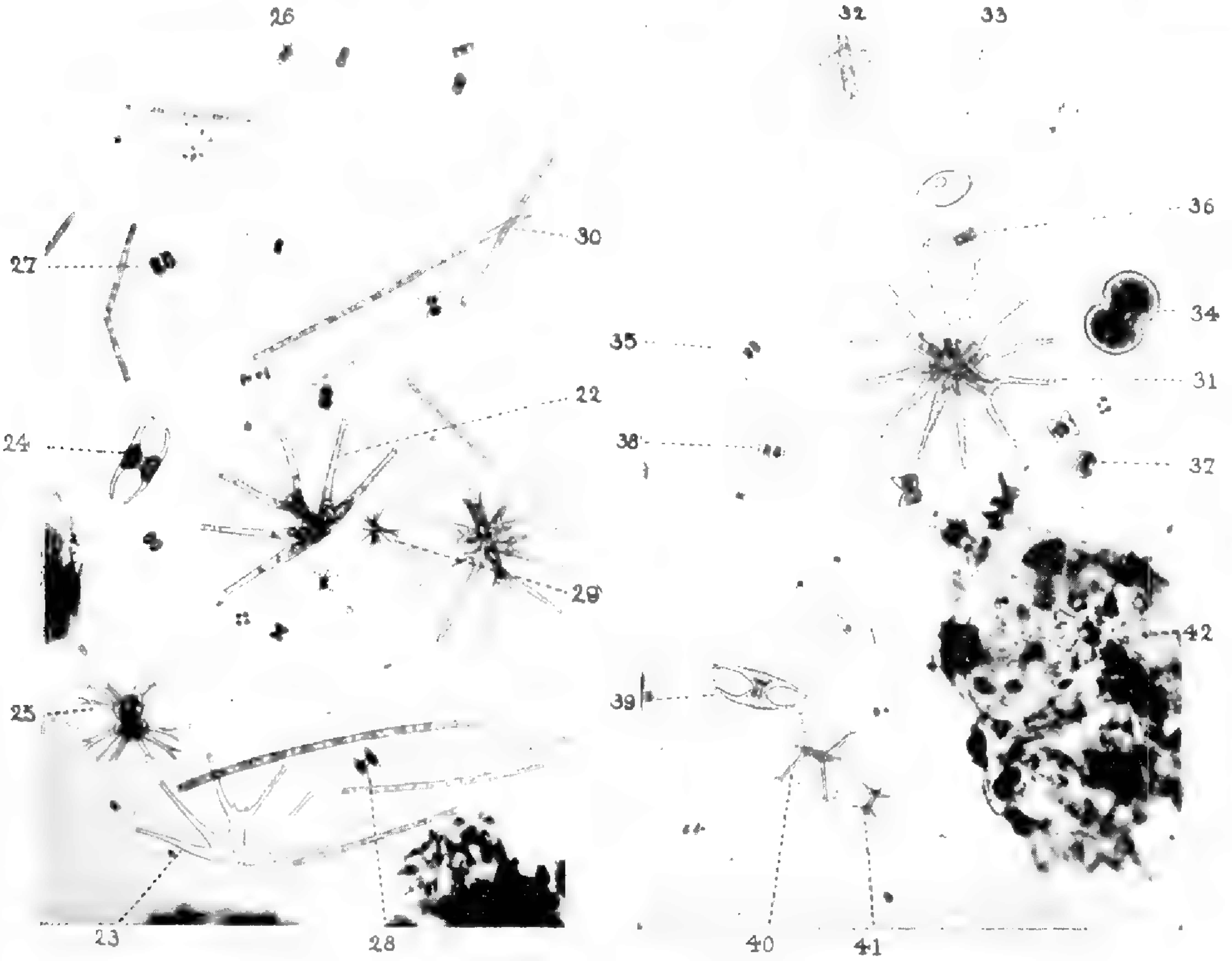
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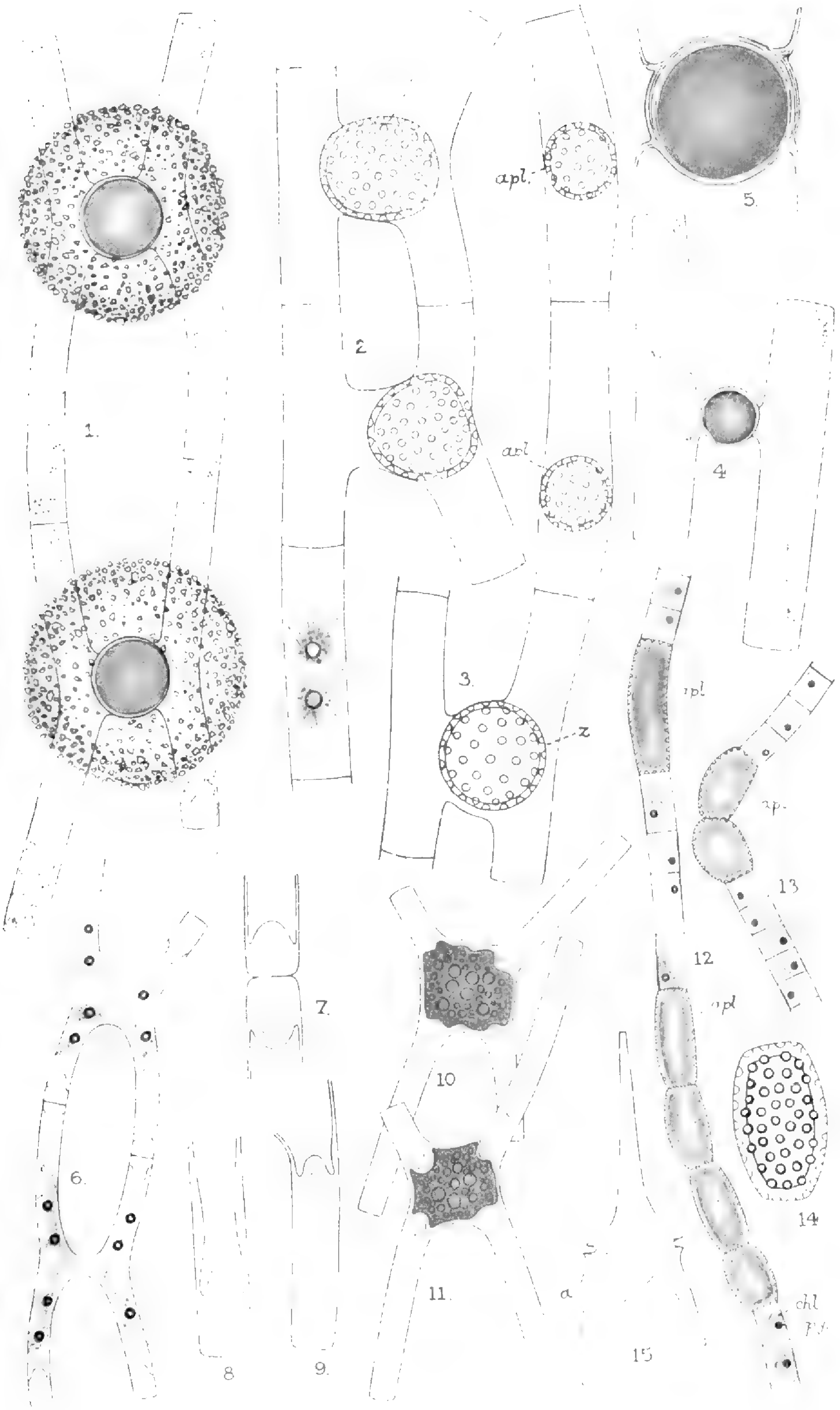
G.S. West photomicrogr

AUSTRALIAN PLANKTON.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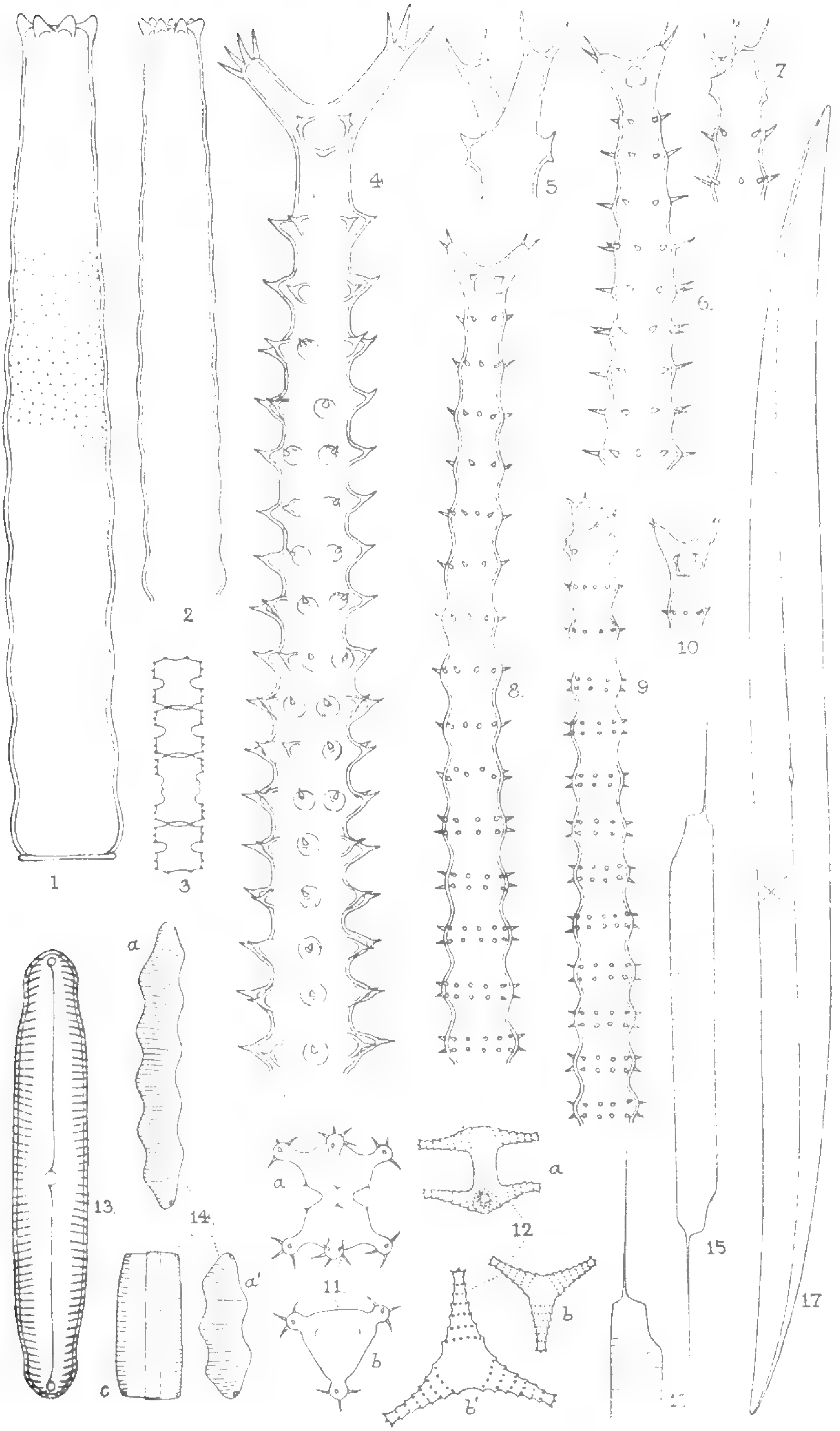
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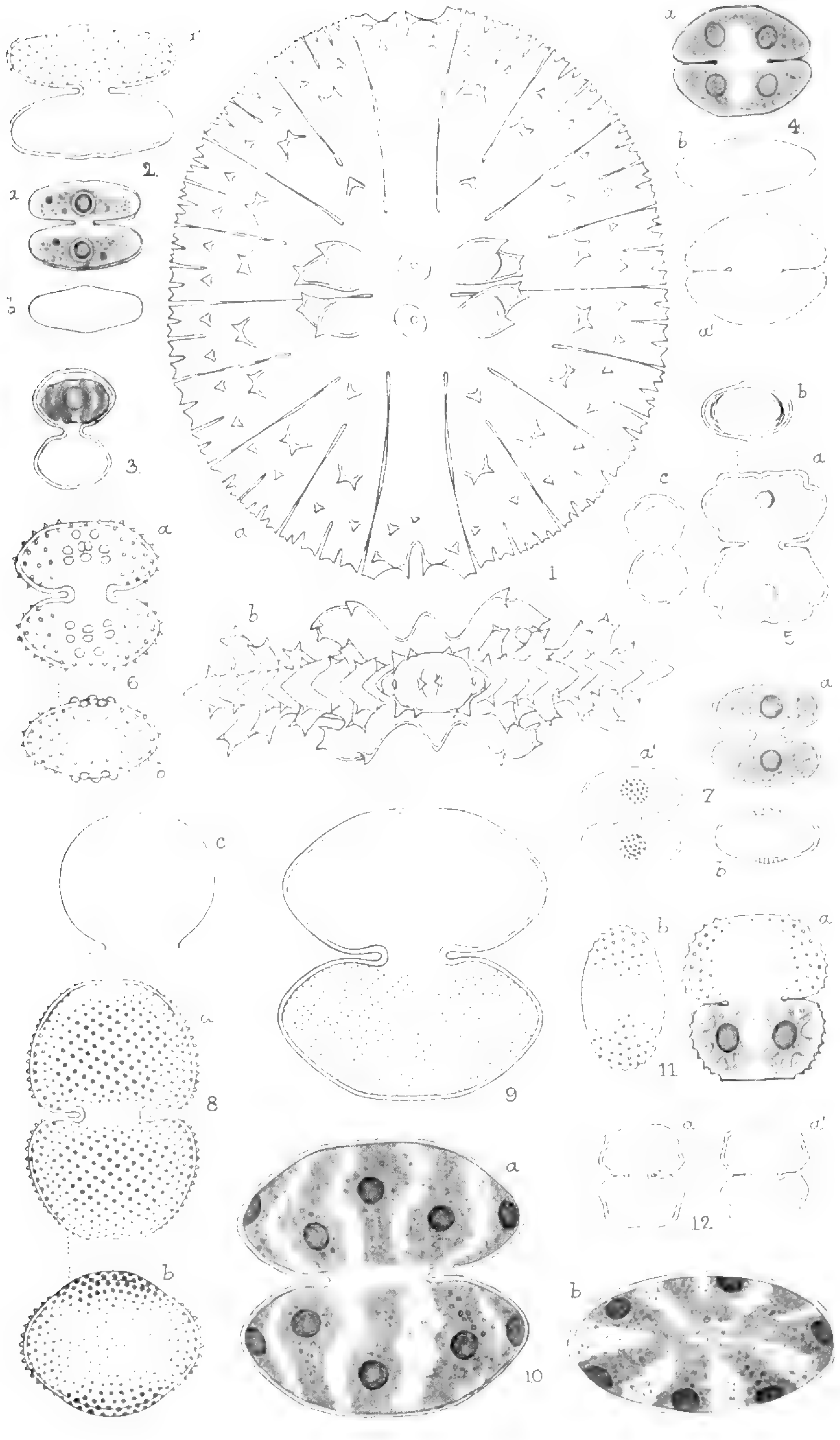
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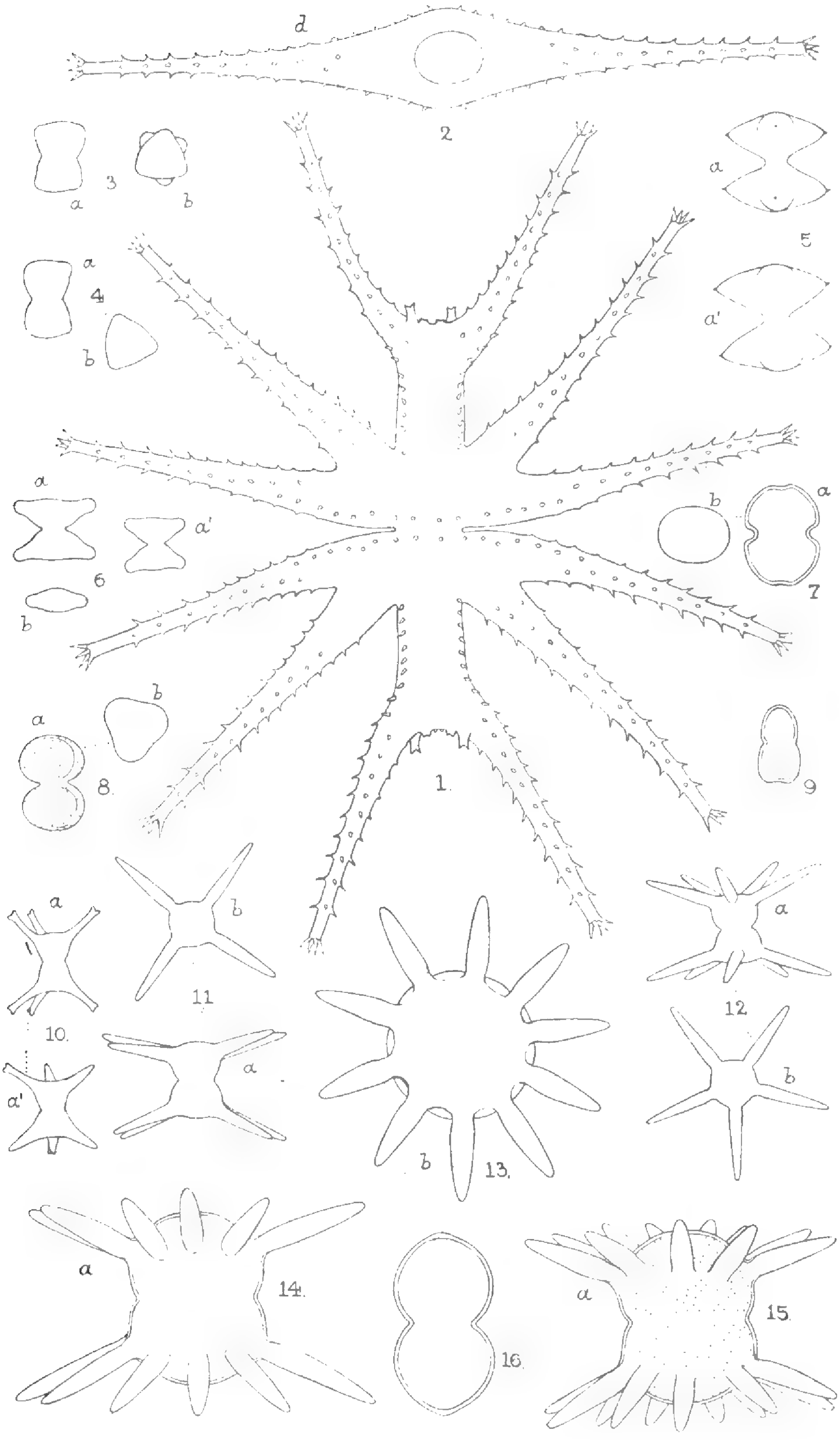
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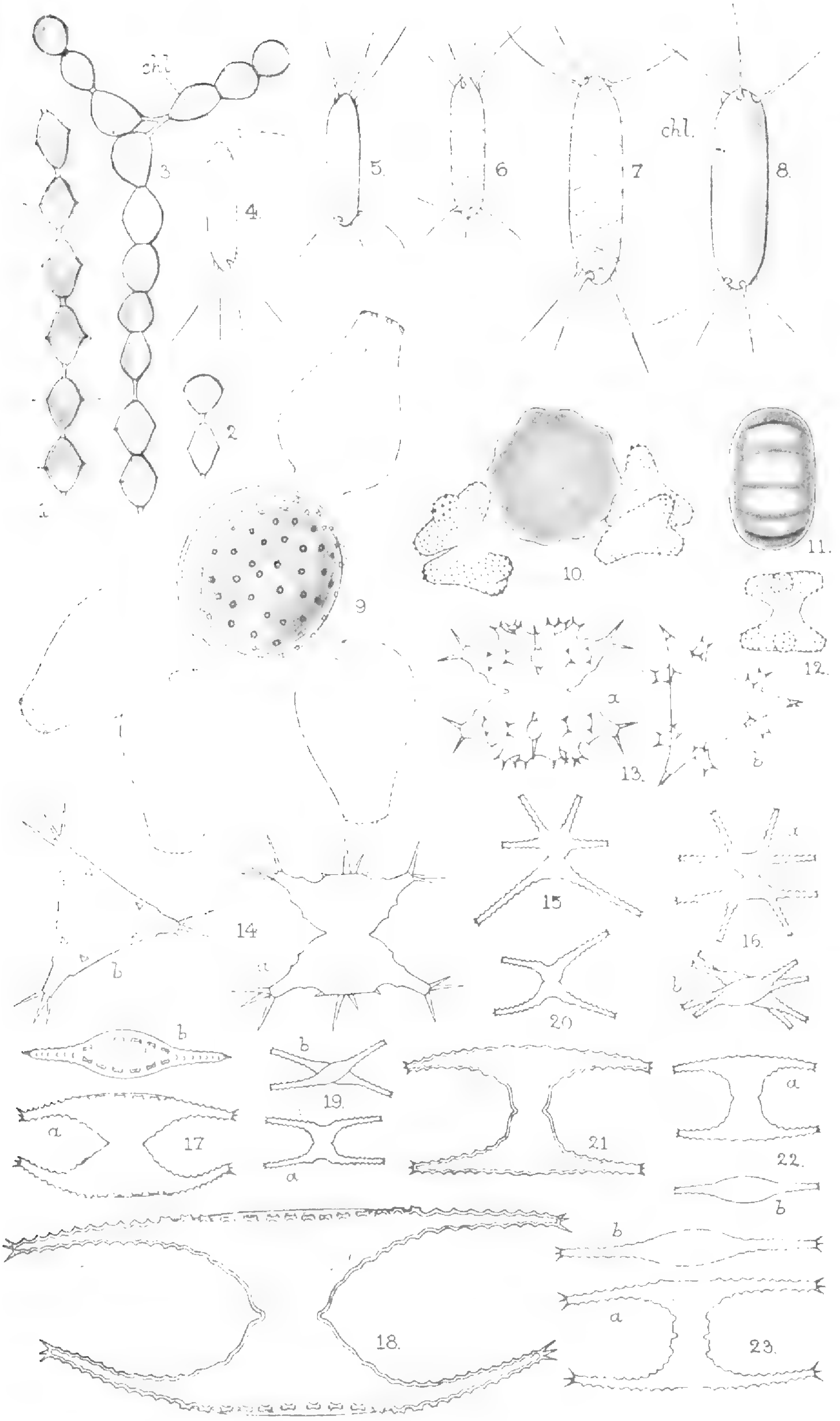
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[*The completion of this paper will be issued shortly.*]

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Note on *Juniperus taxifolia*, Hook. & Arn. By BUNZŌ HAYATA (Tōkyō). (Communicated by W. BOTTING HEMSLEY, F.R.S., F.L.S.)

(PLATE 7.)

[Read 3rd December, 1908.]

THE object of the present paper is to give a full description and illustration of this interesting species and to terminate the confusion of identification, due to the imperfect original description. The present Juniperus was first described by Hooker and Arnott in 'Botany of Beechey's Voyage,' p. 271, as early as 1841, the authors basing their description upon a specimen collected in the Bonin Islands.

So far as I am aware, no complete account has ever been given of this Juniperus. It has been recorded from the Bonin, the Loo-Choo Islands, and some parts of China. I have, however, wondered if this subtropical Juniperus had reached, through the Loo-Choo islands, as far north as China. Therefore, I have been longing to examine the Chinese specimens referred to this species. Fortunately enough, I have enjoyed the opportunity of examining the Chinese plant which was recorded under the name of *J. taxifolia*. The specimens in my hands are two—one of them was sent to Dr. H. Shirasawa from the Royal Gardens, Kew, in the year 1903; the other was collected by Mr. A. Henry, and contributed by him to the Herbarium of the Botanical Institute of Tōkyō. The former is labelled as "E. H. Wilson, W. China, Changyang (Hupeh), No. 428," and the latter as "A. Henry, Prov. Hupeh, No. 2876 A." Both specimens were referred to *J. taxifolia* by the late eminent authority Dr. M. T. Masters, in the Journal of Botany, xli. p. 267, and in the Journal of the Linnean Society, xxvi. p. 543, and xxxvii. p. 413. On examining these specimens, I have found that they are altogether different from the Bonin Juniperus in the shape of leaves, cones, and male flowers. I have no Chinese specimen bearing female flowers. In the Chinese Juniperus the leaves are very acute or even acerose, the male flowers are rather short, the anthers are sessile or stipitate and irregularly arranged, the appendices of the connectives are inconspicuous or sometimes obsolete, and the fruits bear pointed vestiges of the innermost bracts. In the Bonin Juniperus the leaves are obtuse, the male flowers are much longer, the anthers are sessile, never stipitate, regularly arranged, the appendices of the connectives are very clearly seen, and the fruits bear rounded vestiges of the innermost bracts, and usually also of the bracts of the next series. On account of these differences, I think the Chinese Juniperus is not *J. taxifolia*, and must receive a new name. But at present I am not in a position to describe the Chinese species, as I have not yet a perfect specimen of it.

---

* Gordon, 'The Pinetum,' ed. 3, p. 139; Beissner, 'Handbuch der Nadelholzkunde,' p. 131.

I add a full description of the Bonin plant based upon a very perfect specimen from the same islands, which I owe to the kindness of Mr. H. Hattori.

JUNIPERUS TAXIFOLIA, *Hook. et Arn. in Bot. Beech. Voy.* p. 271. (Pl. **7.**)

Arbuscula circ. 10 pedalis, trunco plus minus tortuoso, ramis horizontaliter patentibus, ramulis pendulis. Ramuli novelli triquetri, angulis subalatis, glabri. Folia linearia, 12 mm. longa, 1·5 mm. lata, obtusiuscula, patula, per triennium persistentia, basi articulata, sessilia, ternato-verticillata, integerrima, glabra, superne concava, glauca, subtus obtuse carinata. Flores amentacei, dioecii. Amenta ♂ ex axillis foliorum annotinorum solitaria, cylindracea, obtusa, 5 mm. longa. Stamina 8–10, ternato-verticillata, dense imbricata, sessilia; connectivi appendicula squamiformis, late triangularis, obtusa, basi rotundata, ferruginea, obscure carinata, in ejus basi dorso anthera pendula, loculis 5–6 ellipticis utrinque obtusis 2-valvibus longitudinaliter dehiscentibus. Amenta ♀ ex axillis foliorum annotinorum solitaria, globoso-elliptica, 3 mm. longa, squamis 3–4-seriatim ternato-verticillatis. Squamæ intimæ 3, verticillatæ, crassiusculæ, basi leviter connectæ, subrotundatæ, obtusissimæ, cæterum liberæ, triangulares, obtusæ, dense imbricatæ. Ovula 3, erecta, cum squamis intimis alternantia, post fœcundationem squamis auctis clausis operta. Galbulus globosus, 8–10 mm. in diametro, carnosus, extus squamarum apicibus et marginibus prominulis notatus, cœruleo-fuscus. Semina 3, erecta, trigono-elliptica, subcomplanata, apice breviter costata, mucronata; testa ossea, in faciebus dorsalibus glandulis 2–3 resiniferis oblongis insculptis notata, in ventrali facie pauciglandulosa.

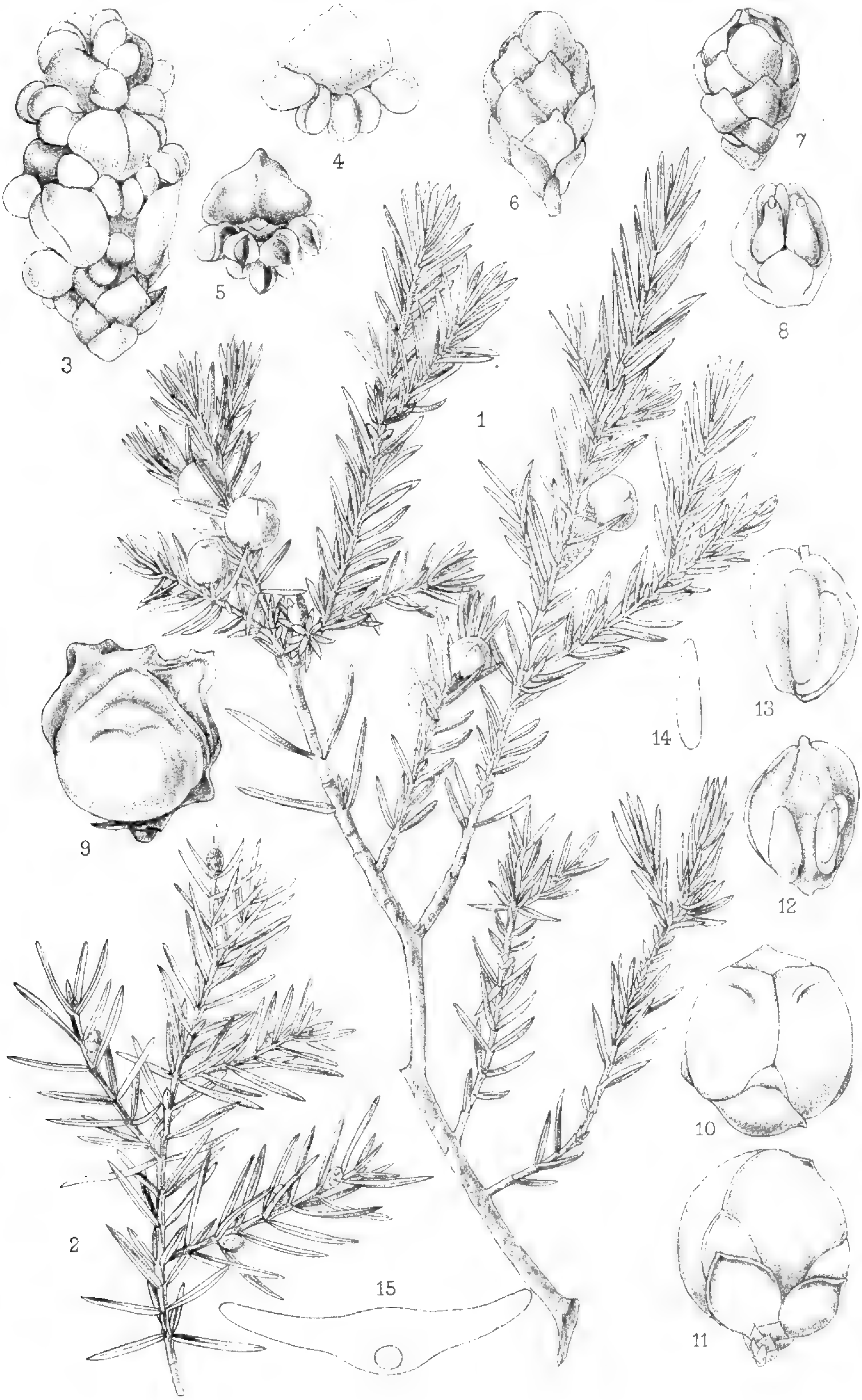
Hab. Bonin Islands (*F. Kawate*, 1908).

Distrib. Loo-choo Islands.

EXPLANATION OF PLATE 7.

Fig. 1. Fragment of a branch bearing fruits, natural size.
2. Fragment of a branch bearing male flowers, natural size.
3. Male flower.
4. Stamen seen from without.
5. The same stamen seen from within.
6. Female flower.
7. The same flower seen from a little above.
8. Apical portion of the same flower, one of the innermost bracts taken off, showing three ovules alternate to the bracts.
9. Young fruit, showing the innermost bracts much enlarged after fertilization.
10. Fruit seen from a little above.
11. The same fruit seen from a little below.
12. Seed, dorsal view.
13. The same seed, ventral view.
14. Embryo.
15. Section of a leaf.

(Figs. 3–15 are more or less enlarged.)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J. N. Fitch lith.　　West, Newman imp.

JUNIPERUS TAXIFOLIA.

The Forms of Flowers in *Valeriana dioica*, L. By R. P. Gregory, M.A., University Lecturer in Botany, Cambridge. (Communicated by A. C. Seward, F.R.S., F.L.S.)

(Plate 8.)

[Read 17th December, 1908.]

In 1877 Hermann Müller * described four forms of *Valeriana dioica*, L., distinguished one from the other by structural peculiarities of the flowers. The descriptions which Müller gave of these forms are:—(1) male, without the rudiment of a pistil, with the largest corolla; (2) male, with the rudiment of a pistil, with a rather smaller corolla; (3) female, with distinct rudiments of anthers, with a still smaller corolla; (4) female, with scarcely visible rudiments of anthers, with the smallest corolla.

A somewhat similar case of dimorphic male and female forms, occurring in *Rhamnus catharticus*, is described by Darwin †. A comparison of Müller's figures and descriptions with those of Darwin, suggests that Müller's first form of *Valeriana dioica* corresponds with what Darwin called the "short-styled male" of *Rhamnus*; the second form with the "long-styled male"; the third with the "short-styled female," and the fourth with the "long-styled female."

Darwin's description of the various forms of *Rhamnus* indicates that we are there dealing with a diœcious heterostyled plant. To work experimentally with such a plant as *Rhamnus* is out of the question, but it seemed likely that *Valeriana dioica* offered a parallel case, in which some results might be hoped for from experimental breeding. For several reasons the Valerian has proved unsatisfactory as a subject for experimental work, but during the past six summers numerous observations have been made upon the forms of flowers which occur in the species. It is with these observations that the present paper deals.

In May 1903, forty-six plants of *Valeriana dioica* were brought in for experimental purposes from Dernford Fen, near Cambridge, where they were growing wild. These and their offspring (which numbered about four hundred), together with numerous wild plants, which were examined from time to time at Dernford and Wicken Fens, form the material upon which the observations were made. I have no exact record of the total number of plants which I have examined, but it is well over a thousand.

Four fairly definite types of flower can be recognized among the plants which have come under my notice. If suitable examples be chosen there is no difficulty in discriminating between these four types, but each type-form is connected with the next in the series by a number of intermediate forms, which so completely fill in the gaps between the types, that the latter can only be looked upon as the central forms of the groups in which it is convenient to arrange the various forms of flower *.

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* "Das Variiren der Grösse gefärbter Blütenhüllen," Kosmos, Bd. ii. 1877, p. 131.

† 'Forms of Flowers,' p. 294 (in Reprint of 1892).

For the sake of convenience I have applied Darwin's terms of "long-styled" and "short-styled" to the two type-forms in the males, since these terms fairly describe the main point of difference between them. At the same time it must be pointed out that, in *Valeriana dioica*, there is no sharp discontinuity between the two forms, such as the use of these terms might, by analogy, seem to imply.

Among the female plants, I have found large numbers of plants which agree with the description of Müller's fourth class :—" Female, with scarcely visible rudiments of anthers" ; but with regard to his third group there is some doubt. Perhaps it corresponds with those plants which it has seemed to me to be best to class as hermaphrodites.

In the following descriptions, therefore, the four groups are called : (1) short-styled male ; (2) long-styled male ; (3) hermaphrodite ; (4) female. Of these the last is much the most easily recognized, and perhaps shows fewer transitional forms, if only for the reason that, in the production of pollen, one has a definite character which marks off the hermaphrodite. For this reason the description of this form is given first, and is followed by those of the other forms, in the reverse order to that used by Müller.

Female Plants.

The great majority of the female plants which I have examined have borne flowers which correspond well with the description of Müller's fourth type—"Female, with scarcely visible rudiments of anthers, with the smallest corolla."

These plants can be recognized readily by means of the small corolla and relatively inconspicuous flowers. The fully open flower measures about 4 mm. from the base of the inferior ovary to the tips of the petals. In such a flower the ovary will be about 2·5 mm. long, the corolla about 1·5 mm. long, while the style projects beyond the corolla-lobes for at least 1 mm. (Pl. **8**. fig. 1).

These measurements are of course only roughly approximate ; the more so as the relative sizes of the various parts vary very much as the age of the flower increases. In the newly opened flower, the style scarcely projects at all beyond the corolla, and the ovary is relatively short (figs. 3, 3 *a*). As the flower ages, the style undergoes marked elongation and the ovary increases rapidly in size.

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* Müller leaves open the question of the existence of forms intermediate between his types.

The stamens of these flowers are the merest rudiments, in by far the largest number of cases, and are scarcely visible from above (figs. 3 *a*, 4). There is, however, considerable variation in this respect, not only as regards the flowers of different female plants, but also between different flowers of the same individual plant. Of course, the degree of visibility of the stamens depends to some extent upon characters, such, for instance, as the openness of the throat of the corolla, which have nothing to do with the stamens themselves. It depends, too, on the age of the flower, the stamens being somewhat more conspicuous in the young flower. But there is also a real variation not dependent on such factors as these, which is sufficiently great to render the stamens, in some cases, easily visible from above. The variation may be either in the size of the rudimentary anthers, or in the length of the filaments, or in both (see figs. 5, 6).

In the more extreme forms of this variation, the staminal rudiments are sufficiently obvious to give rise to some doubt as to whether the plants might not correctly be placed under Müller's third type—"Female, with distinct rudiments of anthers." Especially is this the case when this variation is accompanied by another, in the form of an unusually large corolla. The combined effect of masses of such flowers upon the general appearance of the flower-head is such that the plants could be picked out from the other female plants of more usual type, among which they were growing. The plants were therefore kept under observation for two or three years, when it became quite clear that no real line of separation could be drawn between them and the more usual types into which they grade.

Although such plants as these just mentioned cannot be separated from the females, on the other hand, in their more extreme forms (see figures 10, 11, 11 *a*, 11 *b*) they closely approach another type of flower which is hermaphrodite both in structure and function.

Plants with Hermaphrodite Flowers.

In making the records of the plants examined, I have included under the title "Hermaphrodite," all plants which produced pollen and indicated, by the continued growth of the ovary after the corolla had fallen and by the development of a pappus, the power to produce good seed. The possibilities of testing the seed produced by these plants were limited; the wild plants had already begun to set seed from the earlier flowers when they were transferred to the garden, but they suffered so much from the transplanting during their flowering period that only one plant ripened a few seeds, from which one seedling was obtained. Exceedingly poor harvests were obtained in all cases from plants which had been raised from seed in the garden, and the two hermaphrodite plants were no better than the rest in this respect. In 1905 both plants were badly blighted, in 1906 one of the plants did set four seeds, in spite of the attacks of Aphis, but no seedlings were obtained. As, however, this result is hardly, if at all, worse than that experienced in the attempts to obtain seed from the ordinary females which were raised in captivity, it does not reflect on the power of the hermaphrodite plants to produce good seed under more favourable conditions.

There is, of course, some variation of flower-structure within the limits of this group of plants as defined above. Even so, the number of plants which fall within the group is very small. In the course of this work I have examined about a thousand plants, of which only eight belonged to the group in question. Two plants *, which I have included with the females, nearly approached this type in all characters but the production of pollen, while on the other side, the line between the hermaphrodite and the long-styled male forms is not always easy to draw, since it depends chiefly on the negative character of non-production of seed. At the most, however, this uncertainty only affects three plants which I have classed with the males. Of the eight hermaphrodite plants, five were found in the wild state at Dernford Fen, and three have appeared among the offspring obtained by breeding from them.

The flower of the most typical hermaphrodite form (figs. 14, 14 *a*) has a somewhat larger corolla than that of the typical female flower. Neither the style nor the stamens project much beyond the corolla ; the style bears stigmatic lobes at its apex, and the stamens contain pollen, though not always in very large quantity. Such plants as this might perhaps be considered to represent Müller's third type, although his description "with distinct rudiments of anthers" hardly seems to meet the case where good pollen is produced. On the whole, I think both his description and his figures of this type agree more closely with the more extreme forms which I have classed as females.

Among the hermaphrodite forms one meets with variations from the central type just described, approaching respectively the female and the male types. Examples of the former occurred among the offspring of a cross between a female plant and one of the wild hermaphrodite plants. From this cross, 25 offspring were obtained, of which 15 were female of the usual type, and 6 male. The remaining four were provisionally classed as hermaphrodite ; two however failed to give pollen, and had to be placed among the females. It should be noted that these two plants (figs. 10–12) showed distinct structural similarities to the hermaphrodite type. The flowers were rather larger than in the typical female, the staminal rudiments were larger and easily visible, and showed a faint reddish tinge, in which they resembled the distinctly reddish young anthers of the hermaphrodite and male plants, whereas the staminal rudiments of the females are colourless. Further, these two plants, together with the two hermaphrodites obtained from the same cross, were in flower on May 11, 1906, at a time when as yet the only other plants in flower were males.

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* See also p. 93 and Pl. 8. figs. 10, 11.

Both the two hermaphrodite plants produced small quantities of pollen, which appeared to be good. The death of one of these plants, during the winter of 1905–6, prevented further observations on it. The other plant is shown in figs. 13, 13*a*. Although not very different from its sister plants, it had somewhat larger anthers, which showed the reddish tinge like that of the young anthers in male plants. Many of these anthers contained a small amount of pollen, but, on the other hand, those of other flowers of the same plant were devoid of pollen. These two plants therefore approach the female type very nearly.

One other hermaphrodite plant, raised by breeding from another cross, must be placed at the other end of the series of forms, approaching the type of structure shown in the long-styled males (see p. 96). In this plant (figs. 15–18), the corolla was as large as that of the ordinary male plants, the stamens were larger than in the typical hermaphrodite (and therefore very much larger than those of the plants just described), and the stigmatic lobes at the apex of the style were smaller. In 1906 this plant showed its hermaphrodite nature by producing some fruits.

One of the plants found growing wild was of a type almost exactly similar to this. It was used successfully as a male parent in some breeding experiments. These "Hermaphrodite" plants, then, constitute a series of forms, which may be grouped round such a form as that shown in fig. 14 as a central type, but on either side approach the neighbouring classes very closely.

Male Plants.

Müller divides the males into two classes: (1) those without the rudiment of a pistil, with the largest corolla; and (2) those with a rudimentary pistil, with a somewhat smaller corolla.

It may be said at once that, in all the males which have come under my notice, some rudiment of a pistil is present, though it may be scarcely half a millimetre in length, requiring careful dissection of the flower in order to expose it.

There is not, in my experience, any constant difference in the size of the corolla in the different types; and although the usually shorter ovary of the short-styled forms gives a higher value to the ratio (length of the corolla) : (length of the ovary), I have not found the size of the corolla any guide as to the nature of the flower. The point at which the stamens are inserted on the corolla-tube is so nearly the same in the different types, that I have not been able to discriminate between them in this respect. On the other hand, in some cases the size of the ovary may be made use of. Thus in figs. 19 and 20 two sister plants are illustrated, the one long-styled, the other short-styled. In the former, the ovary of the central flower of the cyme in several cases reached, after the corolla had dropped, a length of 3 mm., and in one case was 3·6 mm. long (fig. 22); while the ovaries of the corresponding flowers in the latter plant were never more than 1 mm. long.

The male plants may be fairly readily divided, on inspection, into two classes, according as the style is visible from above, without dissection of the flower, or not. But this line of separation is a very rough one, since the degree of visibility of the style depends upon many other factors than its length, and is largely affected by such characters as the openness of the throat of the corolla, and the development of the hairs in the throat. Moreover, even in plants in which the style ultimately reaches some length, in the younger stages it is much shorter and often quite invisible from above. For these reasons such a line of separation would include, with the short-styled plants, many which, if the classes are to be retained at all, ought to be placed among the long-styled forms.

At an early stage of this investigation it became apparent that, under each of the two classes "long-styled" and "short-styled," more than one type of flower would have to be included. For convenience of recording, five forms were therefore chosen as types, and each plant was entered according to the type which it most nearly resembled. Of the five types A, B, C, D, and E (see figs. 32, 34–37 and explanation of Plate), A and B are long-styled, D and E are short-styled, and C is intermediate between the two. The lengths of the styles in the flowers referred to the different groups were approximately:—

Group A: 2 mm. and over.
Group B: 1·4–1·9 mm.
Group C: 1·1–1·6 mm.
Group D: 0·6–1·0 mm.
Group E: 0·5 mm. and under.

But a really nearer idea of the types may be given by saying that:—

In Group A, the style reaches nearly or quite to the top of the corolla-tube.

In Group B, the style is somewhat shorter, but reaches a point above the level at which the stamens are inserted on the corolla-tube.

In Group C, the style barely reaches the level of the insertion of the stamens.

In Group D, the style does not reach the level of the insertion of the stamens.

In Group E, the style is a very small rudiment.

Plants belonging to group A are easily recognizable, the style standing up prominently in the middle of the corolla-tube in the mature flowers (figs. 21, 23, 25). Plants belonging to the other groups are by no means so easily recognized, for, since the style undergoes elongation while the flower is open, the younger flowers of each type tend to resemble the older flowers of the succeeding one. In addition, there is often considerable variation between the different flowers of the same plant *, apart from any differences due to the age of the flower. In practice, therefore, each plant was recorded as belonging to the group indicated by the structure of that flower which had the longest style, a large number of flowers from each plant being examined in each case, especially in the short-styled plants. It may be mentioned here that flowers of the type C (figs. 29, 35) were most frequently met with on plants which bore other flowers conforming to one or both of the long-styled types, although in one or two cases such flowers were found on plants which otherwise bore only flowers of the short-styled types.

While there is no doubt that the majority of the males can be separated into two groups, according to the length of the style, if care be taken to dissect several fully mature flowers, there is equally no doubt of the existence of a series of connecting forms. I do not wish to suggest that there is any true line of separation whatever between my groups A & B, and D & E, which were used merely for convenience in recording types intermediate between those described by Müller. That such types were of not infrequent occurrence is shown by the fact that of 60 † male plants recorded under this system,

21 were placed in Class A,
4 were recorded as intermediate between A & B,
8 were placed in Class B,
4 were placed in Class C,
6 were placed in Class D,
17 were placed in Class E.
60

Not only are there connecting forms between the various types of male flower, but the long-styled males, in their extreme forms, approach the hermaphrodite type. Thus, one of the plants found in the wild state, which was classed as a long-styled male, had a very well developed style with distinct (stigmatic) lobes at its apex. Two other plants, offspring of a cross [Female × Long-styled male], in some of their flowers approached so nearly the hermaphrodite type, that they were distinguishable from the plant shown in figures 15–18 (which bore fruit) only in their somewhat smaller ovary and

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* One very extreme case of this is referred to later (p. 98.)

† All the offspring of one cross are excluded from these figures, because continued examination of some of the plants has shown that such extreme variation occurs in the different flowers of the same plants, that the accuracy of the classes recorded for the remainder is laid open to doubt (see figures 32–37; and the description on pp. 98, 99).

in the fact that, in their young flowers, the style was not visible from above, whereas it was visible in all the open flowers of the hermaphrodite plant.

Finally, mention must be made of the variation which exists between flowers of the same individual male plant, quite independently of any differences which may be referred to the age of the flower. It is of course a common occurrence that different flowers of the same plant should show slight differences. Not infrequently these differences are more pronounced: thus, the plant shown in figs. 29–31 was classed in 1905, according to the flowers showing the longest style, as type B; in 1906, in the 7 flowers examined, the style scarcely exceeded that of type C. In 1907, this plant gave 16 flowers in which the style was visible from above; from 12 of these 16 flowers the anthers had already dropped, and the style was in most cases clearly visible; in the other four flowers the anthers still remained, and the fact that, in them, the style was only visible with difficulty, serves to illustrate the elongation of the style which takes place with age. But in 8 other flowers, the style could not be seen at all from above. Among the 24 flowers the measures of the $\frac{\text{length of the style}}{\text{length of flower over all}}$ varied from $\frac{1 \cdot 7}{5 \cdot 2}$, in an old flower in which the style was easily visible, to $\frac{1 \cdot 0}{4 \cdot 7}$, in a flower of similar age in which the style was not visible. The former is of type B, approaching type A; the latter scarcely more than type D.

A quite extreme case of the same kind is illustrated in figs. 32–37, which show the different types of flower encountered on the same plant on May 27, 1907. The range of variation is so remarkable that it is worth considering in detail. In 1905, this plant was classed as a short-styled male; in 1906, twelve flowers were taken from one inflorescence of the same plant; of these, ten were of the type E, two of the type D, while flowers taken from another spike showed similar characters. In 1907, the flowers borne on nine inflorescences of this plant were examined and measured. These inflorescences were numbered respectively A I–IV, B I & II, and C I–III. The four heads A I–IV bore flowers corresponding exactly with the description of 1906; some, or all, of the flowers borne on each of the remaining heads were long-styled, while in one case (B II) every type of flower from A to E was represented.

On the inflorescence B I, the flowers ranged between types B–D; the longest style measured 2 mm.,* the shortest was only half that length.

On the inflorescence B II, the range was even greater, viz. from A–E, the majority being B; the longest style recorded was 2·6 mm. in length, the shortest (fig. 37) only 0·4 mm.

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* These measurements apply to the mature state; flowers in which the stamens had withered, or actually fallen, being chosen wherever available.

On the inflorescence C I, most of the flowers were of the types A & B, the styles ranging from 3·2–2·2 mm. in length, but one flower of the type D was found, whose style measured only 1·1 mm.

On the head C II, the only four flowers in a mature condition were all within the limits of the type A, while on the inflorescence C III, four flowers were of the type A, two between A & B, and one of the type B.

Similar, though less extensive, variations having been noticed in other plants, an analysis of several inflorescences was made, in an attempt to discover whether any phyllotactic or symmetrical arrangement of the different types of flower might be found to exist. The flowers in *Valeriana dioica* are borne in a series of opposite axillary cymes; in some cases there seems to be some suggestion that the shortest-styled flowers are generally borne in the lowest pair of cymes. In the spike referred to above as B I, long-styled flowers of the type B were present in all the cymes except the lowest pair. Of the flowers borne in this pair of cymes, only one approached type B; in the four other flowers the style reached respectively 1·2, 1·3, 1·0, and 1·2 mm. in length. That these were not simply young stages is shown by the fact that the anthers had dropped in each flower.

Again, in the inflorescence C I, one flower of the upper cymes had a short style (1·1 mm.), but the average length of the style in the remaining six flowers was 2·8 mm. In the two mature flowers on the lowest cyme the length of the style was only 2·2 mm.; and young flowers, of about the same age taken from the upper and lowest cymes gave, respectively, lengths of 2·0 and 1·6 mm.

In another plant, the flowers of one inflorescence were mostly of the type A, but two flowers of type B were found on the lowest pair of cymes; while on another inflorescence of this plant, in which most of the flowers were of the type B, a few found on the uppermost cymes were type A.

On the other hand, in the inflorescence B II, no sort of arrangement could be discovered. One cyme of the uppermost pair bore five flowers (in three of which the anthers had either withered or dropped), all of type E or D, the styles measuring from 0·4–0·6 mm. The corresponding cyme on the other side of the axis bore three flowers, one near type A, with a style 2·6 mm. long, and two of type D in which the longer style only measured 0·9 mm.

One other type of variation may be mentioned. In one plant all the flowers examined in 1905 had an unusually long corolla-tube below the spur (fig. 28). In these flowers the style measured from 1·8–2 mm. in length, and yet scarcely reached the level at which the stamens were inserted (fig. 28 *a*). In later years this elongation of the tube was less marked and the plant bore several flowers of the type A.

Conclusion.

It appears that the individuals of *Valeriana dioica* may, for convenience, be arranged in classes, distinguished from one another by the relative development of the male and female reproductive organs, and to some extent by the size of the corolla. Each class consists of a number of plants which differ slightly from one another, but may be arranged around a central form, which may be taken as the type for the group. In each group the extreme forms approach very nearly the extreme forms of the neighbouring group or groups; and, while the central forms of each type are easily distinguishable from one another, there is absolutely no sharp line of separation between successive groups, although the intermediate forms occur in relatively small numbers. The wide range of variation shown by flowers of one individual, in certain cases, tends to emphasise this continuity of the series from type to type.

Whether the hermaphrodite plants described above may properly be regarded as a group, or whether they ought to be regarded simply as a series of transitional forms, is a debateable matter. It would be natural to suppose that in a species where the males are separable into two groups, according to the degree of development of the rudiments of the female organs, a corresponding line of division might be found in the sex in which these organs are functional. Müller's class of "Females with distinct rudiments of anthers" corresponds much more closely, I think, with certain forms which I have classed with the females, than it does with the hermaphrodite group; yet I think a separation of these forms from the commoner type of female would be extremely difficult to effect, and the boundaries of the two resulting classes would be even more ill-defined and artificial than they are in the males. On the other hand, the eight hermaphrodite plants would form a group most disproportionately small in comparison with the size of the other groups.

As regards the relative numbers in which the various forms occur, in the wild state at Dernford Fen the males appeared greatly to outnumber the females. On the other hand, of the plants obtained by breeding under cultivation, 298 were females, 3 hermaphrodite, and 65 males. Of the 298 females, 132 were obtained from crosses of which *all* the offspring were female. With regard to the apparent preponderance of males at Dernford Fen, two circumstances, both of which introduce a source of error into any counts which may be made, must be taken into consideration: first, that the flowering period of the males tends to be slightly earlier than that of the females (at any rate when the plants are cultivated in a garden), so that the counts might vary substantially, according to the season at which they were made; second, that, owing to the stoloniferous habit of the plant, the more profusely branched male plant would tend to give rise, vegetatively, to a larger number of apparently separate plants than would the more compact female.

From what has been said above, it will be clear that *Valeriana dioica* is not a favourable subject for experimental work which requires the rapid and accurate determination of the characters of large numbers of offspring. Other sources of difficulty lie in the fact that the plant is a perennial, and frequently does not flower until the third year, and also in that plants raised from seed in the garden have, in my experience, generally proved weakly and very liable to the attacks of Aphis, rarely ripening any useful quantity of good seed. It has therefore been decided to abandon the experimental work begun in 1903. Below I give a summary of such results as have been obtained.

So far as they go, they indicate that:—

(1) The cross (♀ × ♂ Long) may give, according to the individual plant used, either

- (*a*) Both of the parental types, and no others. The total numbers obtained here were 62 ♀, 23 ♂ L., or 2·52 : 1.
- (*b*) Female only, no male offspring. Three crosses gave 116 ♀, 0 ♂.
- (*c*) Two crosses of this type are recorded as giving three types of offspring, viz. 22 ♀, 4 ♂ L., 5 ♂ Sh. But as these records were made before the great variation, which may occur in the flowers of the male plant, was fully realized, I do not wish to lay stress on them.
- (*d*) Male offspring only, occurred in one cross, viz. 0 ♀, 4 ♂ Long.

From the above figures the offspring of one cross are omitted, owing to the widely different types of flower borne on the same male plant (see pp. 98, 99, and figs. 32–37). This cross gave 7 ♀, 9 ♂.

Taking into consideration only the sex of the offspring, we find that the above crosses give, in the cases where both sexes appeared among the offspring, 84 ♀, 32 ♂, or 2·62 : 1.

(2) The cross (♀ × ♂ Short) may give, according to the individual plant used, either

- (*a*) Three types, viz. ♀, ♂ L., and ♂ Sh. This occurred in one cross only, the numbers obtained being 30 ♀, 10 ♂ L., 7 ♂ Sh.
- (*b*) Both parental types, and no others. These occurred in the proportions of 37 ♀, 10 ♂ Sh. (In one of the male plants the style was somewhat longer than usual, reaching type C.)
- (*c*) Female only, no male offspring. One cross gave 16 ♀, 0 ♂.

Taking into consideration only the sex of the offspring, the above crosses give, in the cases where both sexes occur among the offspring, 67 ♀, 27 ♂, or 2·48 : 1.

Combining the results of all the above crosses in which both sexes occur among the offspring, the numbers obtained were 151 ♀, 59 ♂ (including both long- and short-styled), or 2·56 : 1.

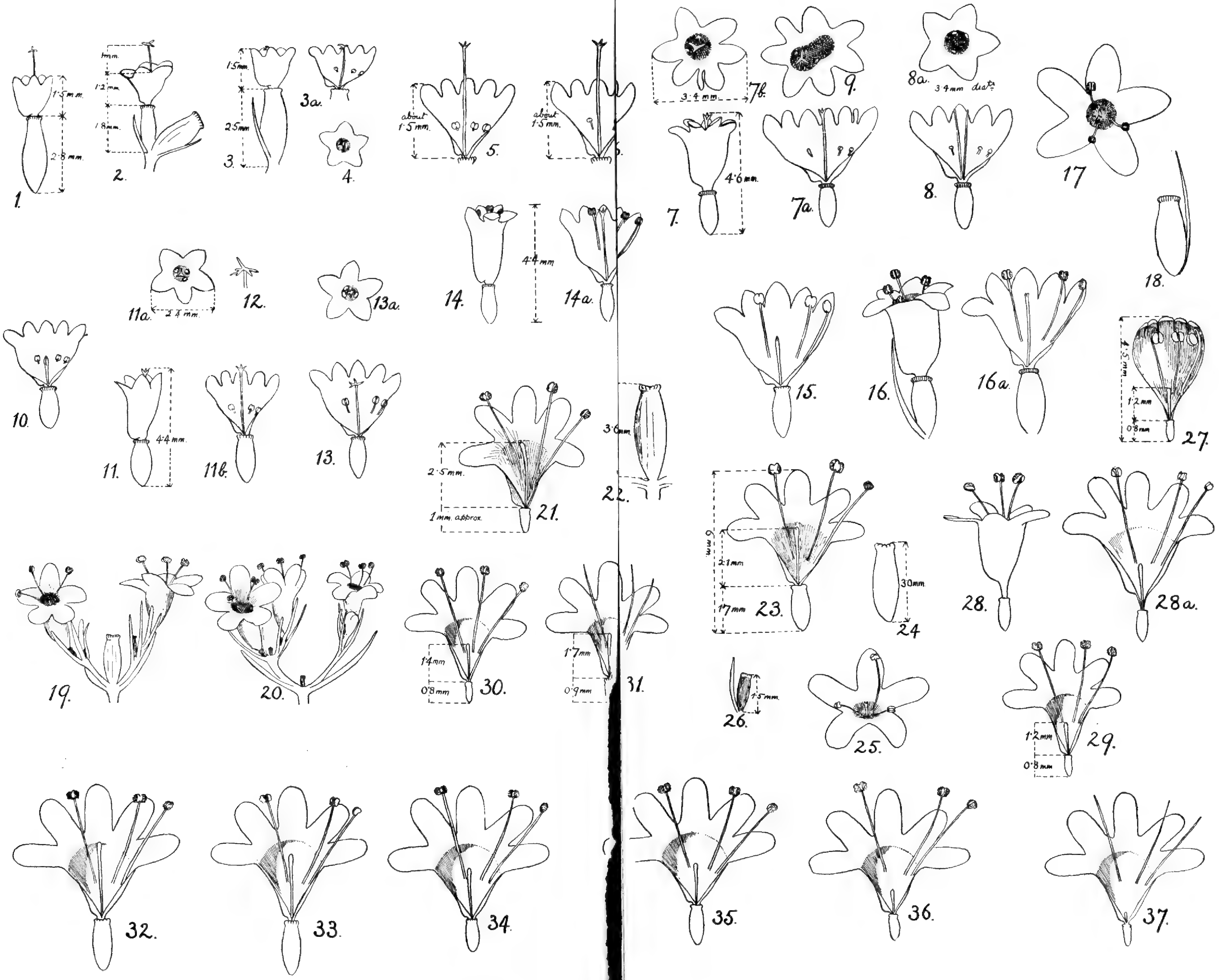
(3) Hermaphrodite plants were only obtained in those crosses in which one of the parents was of that character. In one case the hermaphrodite plant was used as the female parent; one seedling only, an hermaphrodite, was raised. In the other case the hermaphrodite plant was the male parent; the offspring were 15 ♀, 2 ♀ approaching the hermaphrodite form (see p. 93, and figs. 10, 11), 2 ☿, 5 ♂ L., 1 ♂ doubtful (died without producing a sufficient number of flowers; those examined were short).

The most interesting fact shown by the above results is the large preponderance of females which occurs in the offspring. In each type of cross where the two sexes appear among the offspring, this preponderance is in the proportion of, roughly, 2·5 : 1. This ratio may, however, be affected by the power which this species appears to possess of producing seed in the absence of pollination. In the course of these experiments 30 inflorescences, borne upon 20 plants, were covered to prevent accidental pollination, and were left without artificial pollination. The majority of these spikes produced nothing, but from 5 of them 62 fruits were obtained, many of which indeed appeared empty, but others appeared good, and 11 seedlings have been raised from this harvest.

EXPLANATION OF PLATE 8.

The figures are from free-hand sketches drawn to scale from measurements of the flowers represented. The scale is the same for all the figures except Nos. 5, 6, 19, & 20. In figs. 5 and 6 the scale is twice, and in figs. 19 and 20 it is one half, that employed for the other figures. For the sake of clearness no attempt is made, in the figures showing flowers which have been dissected, to represent the hairs which occur in the corolla-tube.

Figs. 1 & 2. Female flowers in side view.
Fig. 3. Young female flower in side view; the style is not yet elongated. Fig. 3 *a*. The same flower seen after the corolla has been split up from the side.
Fig. 4. Diagram of a typical female flower as seen directly from above.
Figs. 5 & 6. Female flowers displayed by splitting up the corolla from the side, to show the variation in the form of the anther rudiments. (The magnification is twice that used for the other figures of female flowers.)


1.
1·5 mm.
2·8 mm.
2.
1mm.
1·2 mm.
1·8 mm.
3.
1·5mm.
2·5mm.
3a.
4.
about 1·5mm.
5.
about 1·5mm.
7b.
3·4 mm.
9.
8a.
3·4 mm diatr.
17.
7.
4·6 mm.
7a.
8.
18.
11a.
2·4 mm.
12.
13a.
14.
4·4 mm
14a.
15.
16.
16a.
4·5 mm
1·2 mm
0·8 mm
27.
10.
11.
4·4 mm.
11b.
13.
2·5 mm.
1 mm. approx.
21.
3·6 mm
22.
6 mm.
2·1 mm
1·7 mm
23.
30 mm
24
28.
28a.
19.
20.
1·4 mm
0·8 mm
30.
1·7 mm
0·9 mm
31.
26.
1·5 mm.
25.
29.
1·2 mm
0·8 mm
32.
33.
34.
35.
36.
37.

R. P. Gregory, del.

FLOWERS OF VAL IANA DIOICA, Linn.

Grout, sc

Figs. 7–9. Flowers of an abnormal female plant. The corolla is relatively very large, and, except in one flower, always divided into more than 5 lobes.

Fig. 7. Side view of a flower showing supernumerary corolla-lobes. Fig. 7 *a*. The same flower after splitting the corolla. Fig. 7 *b*. View from above.

Fig. 8. Flower with two separate styles, displayed by splitting the corolla. Fig. 8 *a*. View from above.

Fig. 9. View from above of a flower with supernumerary corolla-lobes.

Figs. 10–12. Flowers of a female plant which approached the hermaphrodite type in the large corolla and the large staminal rudiments (see p. 93).

Fig. 10. A young flower, in which the style had not yet elongated, displayed by splitting the corolla.

Fig. 11. Side view; fig. 11 *a*, view from above, of a mature flower of the same plant. Fig. 11 *b*. The same flower after splitting the corolla.

Fig. 12. Style from another flower of same plant, to show the splitting of the stigmatic lobes which occurred in many flowers.

Fig. 13. Flower of a sister plant to the foregoing. The anthers were reddish in colour and produced a small quantity of pollen. Fig. 13, the same flower displayed by splitting the corolla; fig. 13 *a*, view from above.

Fig. 14. Flowers of the typical "hermaphrodite" type. It may be noticed that the style does not much exceed the corolla-tube in length. The anthers produced good pollen in fair quantity. Fig. 14, side view; fig. 14 *a*, the same flower displayed by splitting the corolla.

Figs. 15–18. Flowers of an hermaphrodite plant which approached the form of the long-styled male flower.

Fig. 15. A flower in which the anthers had not dehisced, displayed by splitting the corolla, to show the short style of the young flower.

Fig. 16. Side view of a mature flower whose anthers had dehisced. Fig. 16 *a*. The same displayed by splitting the corolla.

Fig. 17. Similar flower seen from above.

Fig. 18. Ovary of a flower from which the corolla dropped.

Figs. 19 & 20. Cymes from two male plants, offspring of the same cross, one long-styled (type A), the other short-styled (type E), showing the marked difference in the size of the ovary of the central (oldest) flower of the cyme. In the left-hand flower of fig. 19, the long style is visible, standing up in the corolla-tube. (The magnification is half that used for the other figures of male flowers.)

Fig. 21. A flower of the plant represented in fig. 19, displayed by splitting the corolla.

Fig. 22. Ovary of central flower of cyme, the corolla having fallen, of the same plant.

Fig. 23. Flower from another plant, displayed by splitting the corolla. The flower is of type A, but the style is rather shorter than in the plant represented in fig. 21.

Fig. 24. Ovary of central flower of cyme of the same plant, for comparison with fig. 22.

Fig. 25. Flower of the type A, from another plant, seen obliquely from above.

Fig. 26. Ovary of a flower, the corolla having fallen, from the same plant. A comparison of figs. 22, 24 & 26 will show the variation in the size of the ovary which exists in different long-styled plants.

Fig. 27. Longitudinal section of the young bud of a flower of the type A. In the young bud the style only reaches to the level at which the stamens are inserted (*cf.* the preceding figures in which the style has reached to the top of the corolla-tube).

Fig. 28. Flowers from one plant showing unusual elongation of the corolla-tube *below* the spur. In these flowers, although the style reached a length of from 1·7 to nearly 2 mm., it was quite invisible from above, and, as shown in the long. sect. (fig. 28 *a*), it did not reach above the level at which the stamens were inserted. Subsequently this plant bore numerous flowers of the type A, and a few of the type B, in which the variation shown in these figures was not present.

Figs. 29–31. Flowers from a plant varying between types B & C.

Fig. 29. A flower of type C, displayed by splitting the corolla. This flower was well open and apparently about the same age as that shown in fig. 30, but not as old as that shown in fig. 31.

Fig. 30. A flower of type B, displayed by splitting the corolla.

Fig. 31. An old flower whose anthers had fallen, displayed by splitting the corolla; from the same plant as the two preceding.

Figs. 32–37 represent the various types of flower which were all borne on one male plant. All the flowers represented were fully mature, while the anthers had withered in that represented in fig. 33, and had fallen in that represented in fig. 37, which had the shortest style of all. (For full description see pp. 98, 99.)

Fig. 32. Type A.

Fig. 33. Type A, but with rather shorter style than the preceding.

Fig. 34. Type B.

Fig. 35. Type C.

Fig. 36. Type D.

Fig. 37. Type E.

Fucus spiralis, Linné, or *Fucus platycarpus*, Thuret: A question of Nomenclature. By F. Börgesen, Ph.D. (Communicated by the General Secretary.)

(Plate 9.)

[Read 4th February, 1909.]

It is indeed rather bewildering that so common a plant as *Fucus spiralis*, L., which occurs, for example, commonly along the whole west coast of Europe, is designated by most botanists under different names in different countries. Prof. Sauvageau has also pointed this out in his recent paper: "Sur deux *Fucus* récoltés a Arcachon (*Fucus platycarpus* et *F. lutarius*)" *.

In this paper Prof. Sauvageau tries to make it clear that we must use the name *Fucus platycarpus* of Thuret for the plant in question, and not *Fucus spiralis*, L., as I have done in my work on the Marine Algæ of the Færöes ('Botany of the Færöes,' Part ii., Copenhagen, 1902, p. 472). Prof. Sauvageau considers that we know nothing certain as to *Fucus spiralis* of Linné; he especially tries to make it clear that the species of Linné includes different forms of *Fucus vesiculosus*, e. g. *F. vesiculosus* f. *sphærocarpa*, common in the northern seas, which Linné might have collected during his journey in Finmarken.

Prof. Sauvageau writes, for instance, p. 16: "Puisque cette variété *sphærocarpus* du *F. vesiculosus* est si répandue et si abondante dans les mers boréales, il est presque évident, *a priori*, que Linné l'a récoltée durant son voyage en Laponie, presque évident aussi que, l'ayant récoltée, il l'a confondue avec son *F. spiralis* lequel, on ne doit l'oublier, est simplement caractérisé par les deux mots: 'inferne nudo,' et non par la nature sexuelle des réceptacles." And on page 23 we read: "Je ne disconviens nullement que le *Fucus* hermaphrodite, corymbiforme et spiralé entrait dans la constitution du *F. spiralis* rencontré par Linné dans son voyage en Laponie, mais celui-ci renfermait certainement aussi les *Fucus vesiculosus* spiralés, le *F. vesiculosus* var. *sphærocarpus* et peut-être d'autres à base 'inferne nudo' des régions boréales." And page 25, repeating the same, Prof. Sauvageau even adds *Pelvetia* and *Fucus inflatus*.

I have thought it right to reprint here my text of *Fucus spiralis* in 'Botany of the Færöes,' pp. 472–477, as perhaps not every reader of the present essay has my paper at hand. I would add, that until my paper appeared, this species not only figured under different names by most authors, as there mentioned, but its different forms were even considered as different species by the same author in the same work. Just to mention one example: De Toni's 'Sylloge Algarum,' vol. iii., where we find *Fucus platycarpus,* Thuret, p. 205, *Fucus vesiculosus* var. *limitaneus,* Mont., pp. 206–7, and *Fucus spiralis,* L., p. 207. I am pleased to see that Prof. Sauvageau quite agrees with me as to the definition of the species.

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* Société scientifique d'Arcachon. Station Biologique. XIème Année Bordeaux, 1908.

In 'Botany of the Færöes,' I have written as follows:—

"FUCUS SPIRALIS, *Linné,* Flora Lapponica, p. 350, No. 467; Species Plantarum, Tom. ii. p. 1159, Holmiæ, 1753; Systema Naturæ, Editio duodecima, Tom. ii. p. 715, Holmiæ, 1767; Kjellm., N. I. p. 252 (202). *Fucus platycarpus,* Thuret, Études phycolog. p. 70. *Fucus Areschougii,* Kjellm., Handb. p. 11. *Fucus vesiculosus β. spiralis* (L.), Lyngb., Hydrophyt. p. 3 (according to the specimens in his herbarium in Copenhagen).

f. TYPICA. *Fucus Areschougii,* Kjellm., the main form, Handb. *l. c.*

f. NANA, *Kjellm.,* Handb. p. 11; *Fucus limitaneus,* Mont., Thuret, *l. c.* pp. 41–42; *Fucus platycarpus,* var. *limitaneus,* Sauvageau, Sur les Algues du golfe de Gascogne, p. 35 (Journal de Botanique, vol. xi. p. 268).

"I am quite convinced that all the species mentioned here and described by different authors (some more may be added to the list, *cfr. e. g.* Thuret and Kjellman, *l. c.*) must be regarded as belonging to Linné's old species *Fucus spiralis.* Linné's description in the works quoted is, though short, yet fairly exhaustive, so a sufficiently clear idea may be formed of what he meant.

"Now the alga named by Thuret *Fucus platycarpus* and figured by him on tab. 16, *l. c.*—original specimens of which were very kindly sent to me from Thuret's herbarium by Prof. Sauvageau—differs rather considerably from what, *e. g.*, Kjellman calls *Fucus Areschougii,* and of which a typical example is to be found in Areschoug's Exsicc. No. 54 (compare also my figure 94 *). But to this I may remark that both in the Firth of Forth near North Berwick, and at Heligoland I gathered specimens which are exactly intermediate between these. And even among my Færöese material I found a very few specimens or portions of plants which reminded one strongly of *Fucus platycarpus,* Thur., *e. g.*, the portion of the plant given in fig. 95 †, the other part of the same plant being like the main species. My opinion is, that Thuret's *Fucus platycarpus* is a more southerly variety of *Fucus spiralis,* while the typical form occurs more particularly in the northern regions, but may also be found growing together with var. *platycarpa* in the southern. I would point out as particularly characteristic of var. *platycarpa* that its main branches are distinctly continued along its whole length, while *Fucus spiralis,* L., *typica*—as I regard it, and to which as I said before

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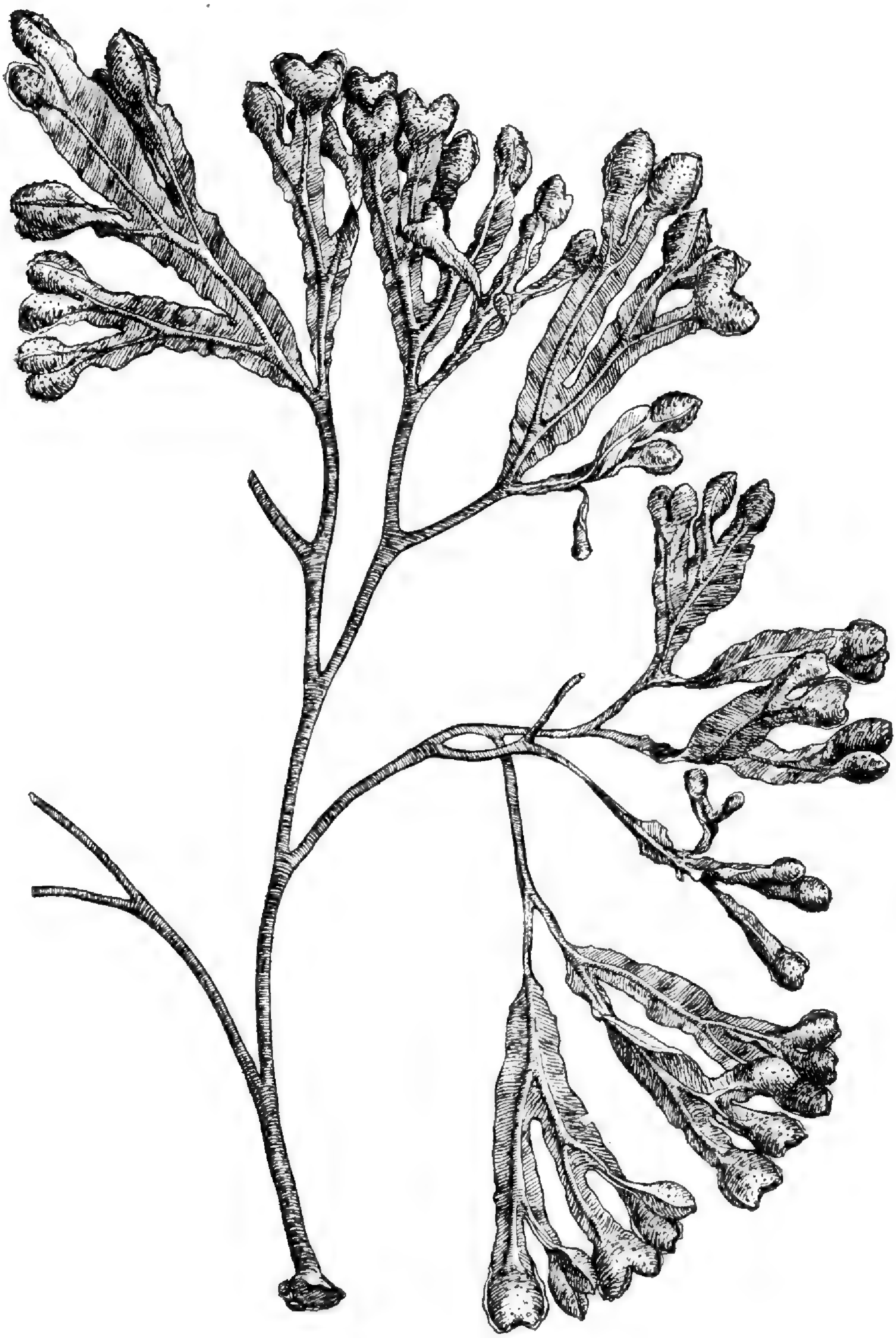
* *I. e.* fig. 1 of the present paper.

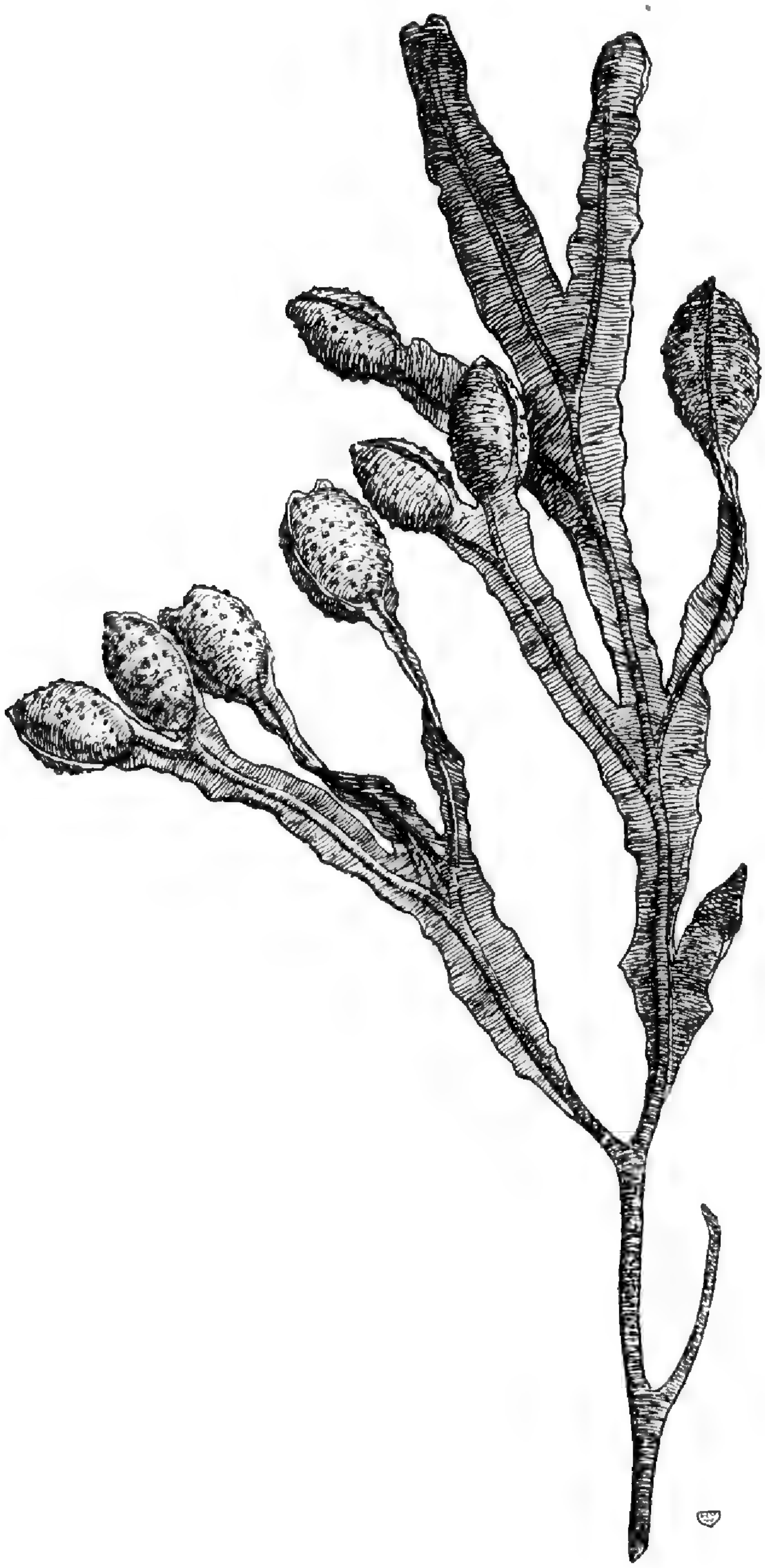
† Fig. 2 on p. 108.

Fig. 1.



Fucus spiralis, L. From Thorshavn. 2/3:1. (H. Westergaard, del.)

Fig. 2.

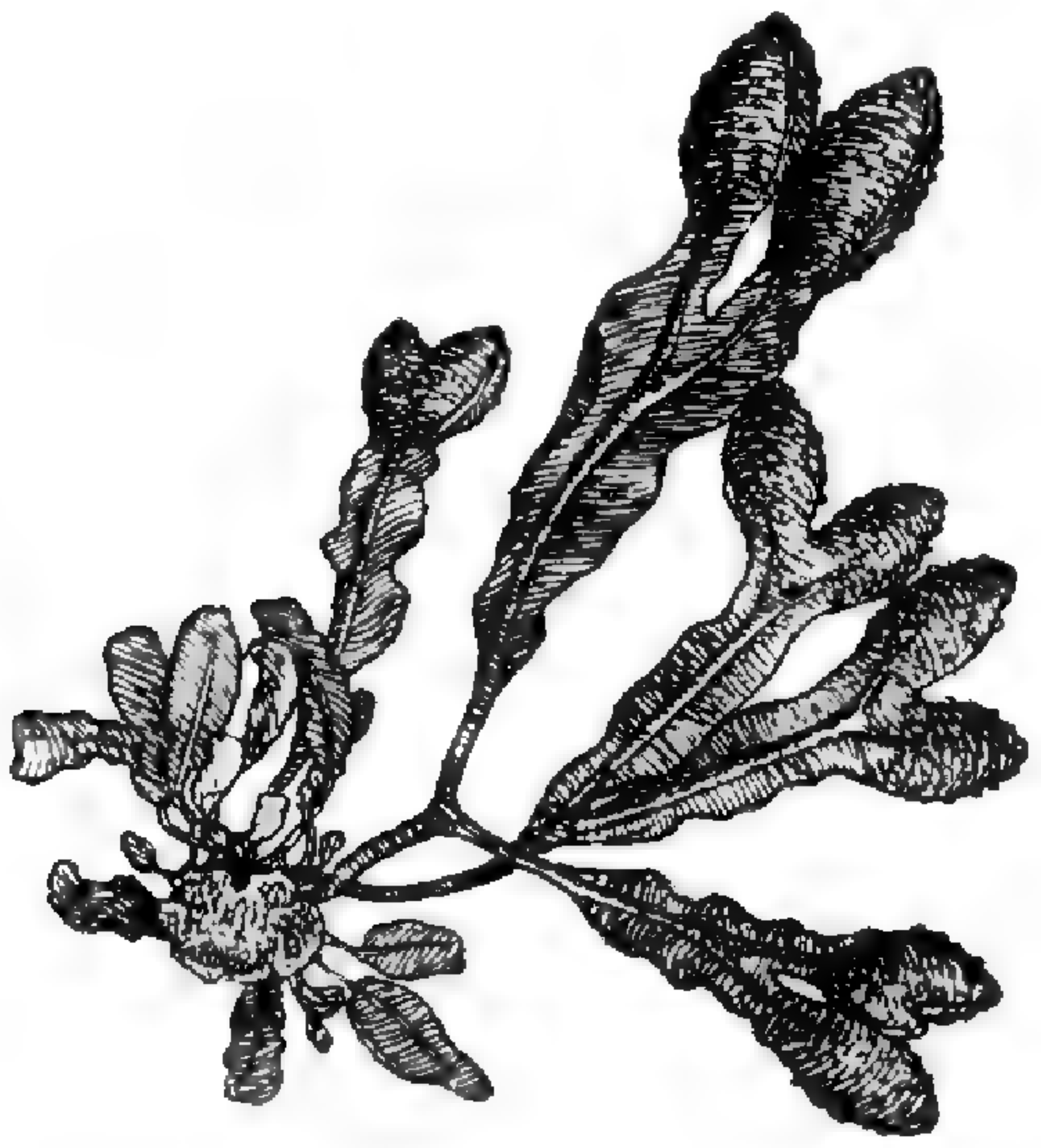


Fucus spiralis, L. Part of a plant approaching var. *platycarpa*, Thur. From Thorshavn. 3/4 : 1. (H. Westergaard, del.)

I refer, e. g., *Fucus Areschougii* as a synonym—has all its branches, even the topmost, distinctly dichotomous, and the latter terminating in receptacles, which are usually more or less swollen and roundish-oval, and occur terminally either two on each branch, or cordate if the bipartition is not complete. On observing a well-pressed herbarium specimen of a typical *Fucus spiralis* (*e.g.*, Areschoug's Exsicc. No. 54), all the receptacles will be seen to occur along the periphery of the plant, while in var. *platycarpa* they are situated along the main branches, beginning from somewhere near their base. It is a pity that Kjellman, who in N. I. refers this species to *Fucus spiralis*, does not give any reason for having in 'Handbok' given it the name *F. Areschougii*. In his description of *β. borealis*, Kjellman just writes in a footnote :—'If the name *Fucus spiralis*, L., agrees with this species, then it must most properly be applied to the northern form.'

"With regard to forma *nana* (fig. 96*), the latter is only a small dwarf form of f. *typica*. I have reported *Fucus limitaneus*, Mont., as synonymous with this form on the strength of some specimens gathered in the Canary Islands by the late Mr. O. Gelert. . . . Further, Prof. Sauvageau kindly sent me specimens of this form from Cap du Figuier in the Bay of Biscay ; he calls them *Fucus platycarpus*, var. *limitaneus* ; and with reference to them he writes, *l. c.* pp. 171–2 :—'En 1896, j'en ai récolté sur un bloc situé en avant du Casino, de petits, grêles et bien fructifiés, en touffes éparses, de 2 à 3 centimètres de longueur, et j'étonnerai probablement les algologues qui ont exploré seulement les régions plus septentrionales, en disant que j'aie pu faire rentrer dans une boîte d'allumettes ma récolte, qui se composait d'une dizaine d'exemplaires bien entiers.' The Færöese specimens from exposed localities are often as small.

Fig. 3.



Fucus spiralis, L., f. *nana*. 1 : 1. (H. Westergaard, del.)

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* 96, *i.e.* figure 3 of this paper, as shown above.

"Several Færöese examples are shown in fig. 97, the small ones being forma *nana*, the large f. *typica*. This species occurs in the littoral zone along the Færöes, and grows in fairly sheltered situations (especially forma *typica*) as well as on exposed coasts (forma *nana*). In more particularly exposed places the latter may be found growing at a considerable height above high-water mark, *e. g.*, at Vaags Ejde it occurred at a height of some 5 metres. It grows by preference on steeply inclined cliffs which are incessantly dashed by the sea in rough weather. On the other hand, in calm weather it often suffers from desiccation, and I have frequently gathered it so dried that it could easily be broken. It always grows gregariously, and this applies especially to forma *nana*. It has also sometimes been found in rock-pools at high levels, *e. g.*, in abundance near Velbestad, specimens from such situations being thinner and of slenderer build, answering to f. *linearis* of *Fucus inflatus*, as f. *nana* answers to f. *disticha*.

"Fructifying plants were found in April, May, June, July, and October. A few specimens gathered in December were sterile. Its period of fructification corresponds exactly to that of plants in the Norwegian Polar Sea where, according to Kjellman *l. c.*, they bear receptacles during summer and a part of October."

Now Prof. Sauvageau thinks that the name of this plant ought to be *Fucus platycarpus*, Thur., with var. *spiralis*., Sauv.; while on the contrary I have called it, and still maintain it ought to be called, *Fucus spiralis*, L., with var. *platycarpa* (Thur.) Börgs.

The question at issue is now: Is Linné's description of *Fucus spiralis* such as would make it quite certain what plant it is applied to?

In 'Species Plantarum,' tom. ii. p. 1159, Holmiæ 1753, Linné gives the following diagnosis:—"Fucus spiralis. Fucus fronde dichotoma integra, caule folium percurrente: inferne nudo, vesiculis verrucosis terminalibus. Fl. lapp. 467. Fl. suec. 1003. Roy. lugdb. 514.

"Fucus spiralis maritimus major, Raj. angl. 3. p. 41.

"Habitat in Oceano."

The diagnosis itself is short, and, but for a single less essential exception, literally like that of *Fucus vesiculosus*, but if the species-name is to be considered, the characteristic twisting of this plant is justly pointed out. However, it is not to be forgotten that Linné, with regard to the diagnosis of *Fucus vesiculosus*, adds: "Fucus marinus f. Quercus maritima vesiculas habens." *

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* Prof. Sauvageau does not mention this, and when he on p. 7 writes:—"Il n'est même pas certain que le nom spécifique soit plus expressif que la diagnose, car Linné appelle les réceptacles vésicules, et tous les *Fucus* mériteraient le même qualificatif de *vesiculosus*," it is not quite correct, as Linné calls the receptacles "vesiculæ verrucosæ," but the vesicles only "vesiculæ."

To get a clear idea as to Linné's plant, we are of course obliged to examine his quotations. In 'Flora Lapponica,' which Linné quotes first, the diagnosis of *Fucus spiralis* is almost the same, but Linné adds: "Spiralis dicitur, quod contorqueat se in spiram, nec facile, si exsiccatur, in planum extendi possit," as a further explanation.

Further, Linné quotes 'Flora Suecica,' where the diagnosis is: "Fucus folio dichotomo integro, caule medium folium transcurrente inferne nudo, vesiculis verrucosis terminatricibus," Roy. lugdb. 514 (which I have not seen), and lastly, Raj. angl. 3. p. 41, where the following description of *Fucus spiralis maritimus major* is written: "Præcedenti proxime accedit, foliis angustioribus, dichotomis, intortis, dodrantem aut pedem longis. Vesiculis caret, extremitates vero seminales, quam in priori, breviores sunt & tumidiores." The previous species to which Ray refers is *Fucus vesiculosus*. Here I do not think there can be any doubt as to the plant intended.

In my paper I quote 'Systema Naturæ,' Editio XII. t. ii. p. 715, where the diagnosis of *Fucus spiralis* is: "Fronde plana dichotoma integerrima punctata: inferne lineari canaliculata, fructif. tuberculatis geminis"; and Linné adds: "Frons membranacea, plana, sed inferne angustior, hinc canaliculata. Fructific. terminales, geminæ, pedunculatæ, oblongæ, crassiusculæ. Dum crescit in mari contortus est in spiram." Linné has here altogether omitted "vesiculæ verrucosæ" from the diagnosis, but instead he gives a detailed description of the terminal, swollen receptacles. The misleading description of the lowest part of the thallus, "inferne lineari canaliculata," which has here been given in the diagnosis, and upon which Prof. Sauvageau lays so much stress, seems to me to be only of secondary significance, and may easily be explained by the fact that Linné has relied on badly prepared plants, which, during the drying process, may easily get the margin somewhat upward bent, or folded together (*cf.* Oeder's figure in 'Flora Danica,' pl. 286, about which more will follow later).

Starting with the diagnosis in 'Species Plantarum,' and the authors quoted by Linné, especially Ray, and also with what Linné has added in his other works quoted by me, it seems to me that all doubt is at an end with regard to the plant which Linné calls *Fucus spiralis*, and that it cannot possibly contain, *e. g.*, forms of *Fucus vesiculosus*, as Prof. Sauvageau suggests.

As we have seen, the plant of Linné is not characterized by the two words only, "inferne nudo," but by a series of essential characters, by which the plant may easily be known, even if Linné had not emphasized the sexual nature of the receptacles (*cf.* the quotation of Prof. Sauvageau, *l. c.* p. 16), an unreasonable demand of Linné considering the period. This statement is well supported by examining the specimens in Linné's herbarium.

During a visit to London in October 1907, I had, through the kindness of the General Secretary of the Linnean Society, Dr. Daydon Jackson, the opportunity of seeing these specimens. Mr. Howe had also seen them earlier, and writes (Bulletin Torrey Bot. Club, 32, 1905, p. 581) that "they seem to support Börgesen's position."

Two specimens are to be found in Linné's herbarium with his inscription "4 spiralis," and as these specimens have a special interest, I shall try to describe them as explicitly as possible, also giving a reproduction of them (Pl. **9**).

Both the specimens are pasted on to small sheets of paper, which are themselves pasted on full-sized sheets, viz. 32 cm. × 21 cm. Linné's writing is on the big sheets, but in one case, in writing the word "*spiralis*," his pen has passed up with the letter "l" on to the smaller sheet.

On the one specimen (upper figure) there is also written in pencil "*Lightfoot?* G," possibly by Dawson Turner, and furthermore a nearly effaced "spiralis" in what Dr. Daydon Jackson thinks to be Linné's handwriting.

Beside this, Dr. Daydon Jackson has also written me the following:—"In the herbarium here, is a sheet of memoranda by Dawson Turner (of Yarmouth), in which he says: '*Fucus spiralis*, 2 specns, one very singular (see sketch by Mr. Hooker), the other, the common small plant.' I do not know where Hooker's sketches are at present; but it seems quite clear that Linné wrote up his species as you still understand it, but pinned something else besides, with the same name, to it."

The specimen represented by Pl. **9**, upper figure, is about 10 cm. long; it is badly spread and prepared, the branches are naked at the base, towards the top ½–¾ cm. broad, rather twisted, bearing in the top rounded, sometimes oval bifurcate receptacles about 5–8 cm. long. The plant quite agrees with a smaller specimen of the form, which is commonly found on the shores of the northern seas, viz. with what I call var. *typica*. It is an understood thing that any examination of this unique herbarium, which necessitates a cut into the plant, the specimens of which are so very small, is quite out of the question, and thus a microscopic examination to decide whether these plants are hermaphrodite or not, is impossible; but anybody, having at least some knowledge of *Fucus spiralis*, will, at first sight, admit that it is that plant which we have before us.

The other specimen (Pl. **9**, lower fig.) is only a smaller fragment of a somewhat larger plant. It has an almost even, broad thallus, downwards c. 4 mm. broad, upwards a little broader, the margins bent a little upwards, which has perhaps been the reason of Linné's bewildering statement "hinc canaliculata." The receptacles vary somewhat in form, those in the middle being broadly oval, the others elongated, the longest reaching a length of almost 2 cm., while the short ones are only 1 cm. long and ¾ cm. broad. The whole length of the specimen is 18 cm.

On sending me a photograph of this plant, Dr. Howe asked for my opinion of it, when I answered, "It may be *Fucus spiralis*, but it may also very well be a form of '*Fucus inflatus*.'"

Both these species are hermaphrodite, and some of their forms may give rise to difficulties * when studied in the herbaria; but in nature, where these species occur together, it will always be easy to decide to what species a given specimen belongs, as they grow at different tide-levels, viz.: *Fucus inflatus* on sheltered coasts at about low-water mark, while *Fucus spiralis* occurs at about high-water mark. As before said, I dare not say anything decided as to this specimen; the long receptacles suggest *Fucus inflatus*, while the short roundish ones might belong to *Fucus spiralis*, L.: possibly we have to do with a bastard of these two species.

Even if one of Linné's specimens is doubtful, it is my opinion that we have sufficient support in the other typical specimen; no doubt most herbaria have, besides typical specimens, others also more or less differing. At all events the Linnean specimens show that they have nothing in common with *Fucus vesiculosus*, and Prof. Sauvageau's chief complaint against *Fucus spiralis*, L., that this included also forms of *Fucus vesiculosus*, is thus not supported by Linné's herbarium.

Finally I want to emphasize a point which I find is highly in favour of my opinion, namely:—that Linné, in the group of *Fucus*, which he describes as "Dichotomi frondescentes," has the following six species: *serratus*, *vesiculosus*, *ceranoides*, *spiralis*, *inflatus*, and *divaricatus*. With the exception of the last mentioned, which is a form of *Fucus vesiculosus* rich in vesicles, the species which Linné was clear-sighted enough to recognize have remained till to-day. One may contrast with this the great number of species which J. Agardh has in "Bidrag till kännedomen af Spetsbergens Alger" (K. Vet.-Akad. Handl. vol. vii. no. 8, p. 31), and which, for a long time, brought confusion into the systematics of the genus *Fucus*.

Strictly speaking, I could very well stop here, as I think, from what has been already written, that we have gained a sufficiently clear idea of *Fucus spiralis*, L.; but as it is of interest to follow the history of this species to the present day, and as I do not quite agree with Prof. Sauvageau's representation of this also, I shall here enumerate the chief facts.

S. G. Gmelin mentions ('Historia Fucorum,' Petropol. 1768, p. 62) *Fucus spiralis* as a variety of his *Fucus Quercus marina*=*Fucus vesiculosus*, L., while he, in the 13th edition of 'Systema Naturæ,' 1791, p. 1386, has *Fucus spiralis* as a distinct species, but adds: "An vesiculosi varietas?"

While Hudson ('Flora Anglica,' editio altera, tom. 2, London, 1778, p. 577) only copies the diagnosis of Linné in 'Systema Naturæ,' edit. 12, Lightfoot, on the contrary, has an excellent description of this species in 'Flora Scotica' (London, 1777, vol. ii. p. 911).

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* Compare for instance Setchell and Gardner, "Algæ of North-Western America," p. 281, and Yendo, "The Fucaceæ of Japan," where the forms which he calls *Fucus evanescens* and of which he gives an illustration (pl. i. figs. 1 & 2) highly resemble *Fucus spiralis*.

Having first copied the diagnoses of this species in 'Systema Naturæ,' ed. 13, and 'Species Plantarum' ed. 2, p. 1627, Lightfoot gives the following description :—"It has the whole habit of the *F. vesiculosus*, except that, so far as we have seen, it is destitute of air-bladders. The stalk or rib is naked at the base, being made so by the violence of the waves, but we never observed it channelled, as Linnæus mentions. The branches of the leaf are very apt to be twisted spirally in their growth, so as to be expanded with difficulty ; and their edges, though naturally entire, are often torn or jagged by the rocks and waves even to the middle rib, appearing as if cut into lanceolate segments. The seminal vesicles grow in pairs at the extremities of the segments, thick, obtuse, and generally bifid."

It seems to me that this description is so inclusive and striking, that we are doing the author an injustice if we have any doubt as to what plant he speaks of.

As to Oeder's figure in 'Flora Danica' (vol. ii. fasc. 5, tab. 286), the oldest existing figure of this species, so far as I know, published as early as 1766, I willingly admit that it is not particularly good. But nevertheless I decidedly maintain that there can be no question as to its being *Fucus spiralis*, L. The specimen used was badly prepared and is highly "canaliculatus" (comp. Linné's description in 'Systema Naturæ,' edit. 12). It has apparently a vesicle, indeed several small ones are figured in some copies, there being a great difference in the reproduction of the various copies. In one copy that we have in the library of the Botanical Garden, Copenhagen, there are besides the larger "vesicle" in the middle of the plant, drawn on the left side of the branch, at a little distance from the midrib, and rather far from its apex, also two small ones, but these are placed in such peculiar parts of the thallus that it is quite clear that they are not real vesicles; they are moreover quite absent from my own copy of 'Flora Danica.' As to the large "vesicle," it is, in both the copies at the Library, drawn in agreement with the receptacles, viz. : with the surface dotted all over; the position would be a peculiar one in which to find a receptacle, but, judging from the dotted surface, it was not intended for a vesicle. In my own copy the vesicle-like body is not dotted, but its outline is rather indistinctly sketched, so that it can scarcely be considered as other than a curving of the thallus which the painter has been at pains to represent. By the way, considering my figure (fig. 1, p. 107) a little closer, it struck me that here also, on the upper side of the lower branch, to the left of the figure, a folding of the thallus is drawn in such a way that it greatly resembles a vesicle.

At the same time it is possible for *Fucus spiralis* to have vesicles, though this would apparently be infrequent. In the herbarium of the Botanical Museum, Copenhagen, a specimen, collected at Haugesund, on the west coast of Norway, by Dr. Rosenvinge, has an oval vesicle about 1¼ cm. long at about ¾ cm.

distance from the apex of the thallus. It is rather like the swellings we commonly find in *Fucus inflatus* *.

Prof. Sauvageau reproaches the modern algologists that they more often quote the figure of Oeder, instead of that of Lamarck in 'Tableau encyclopédique,' vol. iii. pl. 880. But it may be said (1) that this figure is much more recent than Oeder's, and also (2) that it is given as a type of the genus *Fucus* without any text. For the rest I agree willingly with Prof. Sauvageau that we have here a rather good figure of *Fucus spiralis*, L. And a few years later (1808) we also get a good description of it, as Poiret, who continued the publication of Lamarck's 'Encyclopédie méthodique,' quoting Lamarck's figure, gives in Tome 8 (p. 358) of the work a very good description of this species, which he considers as distinct from *Fucus vesiculosus*. Goodenough and Woodward also have in "Observations on British Fuci" (Trans. Linn. Soc. iii. 1795, p. 47) *Fucus spiralis* as a distinct species and give a good description of it.

In 'English Botany,' vol. xxiv. 1807, Smith has given a good figure and description of *Fucus spiralis* (pl. 1685), and regarding its habitat he writes: "Growing about high-water mark, and always in such situations as to be exposed to the air after every tide." Furthermore, he here describes the specimens in Linné's herbarium: "In one of the Linnæan specimens indeed some of these extremities are more oblong, but they are still obtuse and rounded at the ends," evidently pointing to the above mentioned, non-typical, specimen.

Turner, in 'Fuci,' vol. ii., London 1809, on the contrary, considers *Fucus spiralis* as a variety of *Fucus vesiculosus*, agreeing with Roth's conception in 'Flora Germanica.'

Lyngbye also takes the same view in 'Tentamen Hydrophytologiæ,' p. 3, Hauniæ, 1819.

In 'Nereis Britannica,' p. 6, tab. 5, 1816, Stackhouse has a good description of *Fucus spiralis*, which he considers as a species; it is accompanied by a large and a small pretty good figure. In the same paper Stackhouse has also described the species *Fucus Sherardi*, which judging from his figure is nothing else than a sterile specimen of *Fucus spiralis*.

In this way *Fucus spiralis* has been treated sometimes as a species, sometimes as a variety of *Fucus vesiculosus*, or as a synonym of *Fucus vesiculosus* (Greville (1830) and Harvey (1846–51)). In the middle of the century there appeared Thuret's important treatise, "Recherches sur les zoospores des Algues et les anthéridies des Cryptogames" (Ann. Sc. nat., sér. 3, vol. xvi.

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* Prof. Sauvageau also mentions such swellings in "Note sur les Algues marines du Golfe de Gascogne," p. 22, and also Thuret and Bornet mention them in "Études Phycologiques," p. 40.

1851)*. In this work Thuret describes (p. 57) the new species *Fucus platycarpus*, which was distinguished firstly by its hermaphrodite condition in contradistinction to *Fucus serratus*, *ceranoides*, and *vesiculosus*, which have unisexual receptacles †, and secondly, and especially, by its "receptaculis lateralibus," which were so different from the hitherto known form of *Fucus spiralis*, that it is quite natural that Thuret should consider it to be a new and characteristic species.

However, if Thuret had not happened to work on the coasts of Normandy but instead on the coasts of the Færöes or Norway, he would certainly have arrived at another conclusion. He would then have discovered that the hermaphrodite condition is not only characteristic of *Fucus spiralis* but also of *Fucus inflatus* ; he would furthermore have been able to study the old well-known forms of *Fucus spiralis*, and would of course have used Linné's name.

The strange form of the var. *platycarpa* in conjunction with the discovery of its hermaphrodism, which Thuret thought characteristic of it alone, made him introduce his species.

Not until much later on (1878) did Thuret and Bornet give in 'Etudes Phycologiques' an account of forms, described by earlier authors, which, in their opinion, ought to be classed with the *Fucus platycarpus*, and they mention here, first of all *Fucus spiralis*, L. et auct. partim.

It is interesting to see that the brothers Crouan, the year after, in their excellent exsiccata, "Algues marines du Finistère," No. 103, distributed a *Fucus* which they indicate as *F. vesiculosus* var. *spiralis*=*Fucus spiralis*, L., a specimen closely allied to the var. *typica*, whereas the next number 104 is var. *platycarpa*, by Crouan called *Fucus vesiculosus* var. *evesiculosus*, Cr.=*Fucus evesiculosus*, Bory=*Fucus Thuretii*, Le Jolis MS. Thus the brothers Crouan consider here the two forms as different, and in contradiction to Greville and Harvey as varieties of *Fucus vesiculosus*. It is also rather peculiar that they do not use Thuret's name for No. 104, but this may possibly be due to the short time that elapsed between the publication of Thuret's work and Crouan's exsiccata. If we now follow *Fucus spiralis*, L., and *Fucus platycarpus*, Thur., up to the present time we shall discover that, as a rule, they are considered as different species.

Areschoug has thus in his paper: "Slägtena *Fucus* (L.) Decaisne et Thuret och *Pycnophycus* Kütz., jemte tillhörande arter" (Bot. Notiser, 1868, p. 106), *Fucus platycarpus*, Thur., and *Fucus Sherardi*, Stackh., *a. spiralis*.

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* In an earlier paper, which Thuret had already edited together with Decaisne, "Recherches sur les anthéridies et les spores de quelques *Fucus*" (Ann. Sc. nat., sér. 3, vol. iii. 1845), it is shown that diœcious, as well as hermaphrodite, species of *Fucus* are to be found.

† Regarding *Fucus ceranoides* this statement of Thuret is not quite right, as *Fucus ceranoides*, as Le Jolis (Liste des Algues marines de Cherbourg, 1863, p. 95) has pointed out, may sometimes appear diœcious, sometimes hermaphrodite.

To the latter he refers the alga distributed as *Fucus platycarpus* in Alg. Scand. No. 54, but he points out that on further reflection he considers them to be different species, on account of the ramification of Thuret's plant. Areschoug quotes as synonym of *Fucus Sherardi* var. *spiralis*, *Fucus spiralis*, L., and adds as an explanation as to why he uses Stackhouse's name, instead of that of Linné, that the latter has reference to changes due to casual or local conditions *. This proceeding is of course quite unjustifiable, even if it really should be the case. We also notice that Kjellman, in 'The Algæ of the Arctic Sea,' p. 202, consequently uses Linné's name, "*Fucus spiralis*, L., Spec. Plant. 2. p. 1159, sec Aresch. Fuc. et Pycnoph. p. 106," and furthermore enumerates :

"Descr. *Fucus Sherardi* ***a*** *spiralis*, Aresch. l. c.
Fig. —— *spiralis*, Fl. Dan. t. 286 : non bona.
Exsicc. —— *platycarpus*, Aresch. Alg. Scand. exsicc. No. 54."

Fucus platycarpus of Thuret is not mentioned : this plant Kjellman, who liked small specific differences, surely considered as a species distinct from Areschoug's plant ; and this view of his has been furthermore expressed in his 'Handbok i Skandinaviens Hafsalgflora,' Stockholm 1890, p. 11, where he gives to the form of Areschoug the name of *Fucus Areschougii* †.

In the same year as the 'Handbok' of Kjellman appeared, Foslie has in "Contribution to the Knowledge of the Marine Algæ of Norway : I. East-Finmarken" (Tromsö Mus. Aarshefter, xiii. p. 66, 1890), *Fucus spiralis*, L., as a distinct species.

To further mention a few examples from later days, Collins has in 1896 (Bull. Torr. Bot. Club, vol. xxiii. p. 5) a *Fucus Areschougii* about which he says, that it is closely related to *Fucus platycarpus* : "there may be intermediate forms, but the types seem distinct, *Fucus platycarpus* being a larger plant, with broader frond, having the fruiting segments lateral." And in 'Preliminary Lists of New England Plants.—V. Marine Algæ" (Rhodora, 1900) Collins also has *Fucus Areschougii*, Kjellm., and *Fucus platycarpus*, Thur.

Having already, in the introduction of this paper, mentioned how this species is apprehended by De Toni (1895), I shall only further point out, that in the same year (1902) as my treatise appeared in "Botany of the Færöes," Batters has in 'Catalogue of the British Marine Algæ,' p. 50, *Fucus spiralis*, L. (=*Fucus Areschougii*, Kjellm.) and var. *platycarpa*, Thur. (=*Fucus platycarpus*, Thur.), quite agreeing with me, but not giving any proofs of his point of view.

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* "Antyder endast tillfälliga eller lokala afvikelser."

† Kjellman's reason for giving this plant the new name, *Fucus Areschougii*, was I think because he considered this form as specifically different from *Fucus platycarpus*, Thur., and furthermore he does not use Linné's name because Linné's plant, if I rightly understand his note, l. c. p. 11, in his opinion only included the boreal form occurring on the shores of Nordland and Finmarken.

From what has been said above, it is evident, firstly, that Linné's name for the plant in question has been used up to the present time; the species of Linné being at one time considered as a distinct species, at another as a variety of *Fucus vesiculosus*. When Prof. Sauvageau writes l. c. p. 9: "Il est intéressant de constater que les auteurs acceptèrent d'abord le *F. spiralis*, en firent ensuite une variété du *F. vesiculosus*, puis l'incorporèrent entièrement à celui-ci et enfin l'oublièrent," I cannot quite agree with him; true, Greville and Harvey refer *Fucus spiralis* as a synonym to *Fucus vesiculosus*, but, almost at the same time, the brothers Crouan have, as mentioned above, "*Fucus vesiculosus* var. *spiralis* = *Fucus spiralis*, L."

It is, secondly, evident from what has been said that *Fucus platycarpus*, up to the present time, has been by most authors considered as a species distinct from *Fucus spiralis*, L., or whatever else it be called. But quite recently, more thorough investigations, including my own in the Færöes, have shown that these two forms belong to the same species; a result which, by the way, Dr. Kolderup Rosenvinge arrived at several years ago, relying not only upon his examination in the northern seas, but also on those on the shores of France. Prof. Sauvageau * also adopted this view in 1897 after correspondence with Dr. Rosenvinge, and he maintains it in his latest paper.

But as the matter now stands, and as furthermore proved above, no justifiable doubt can exist as to Linné's *Fucus spiralis* †, and we have nothing

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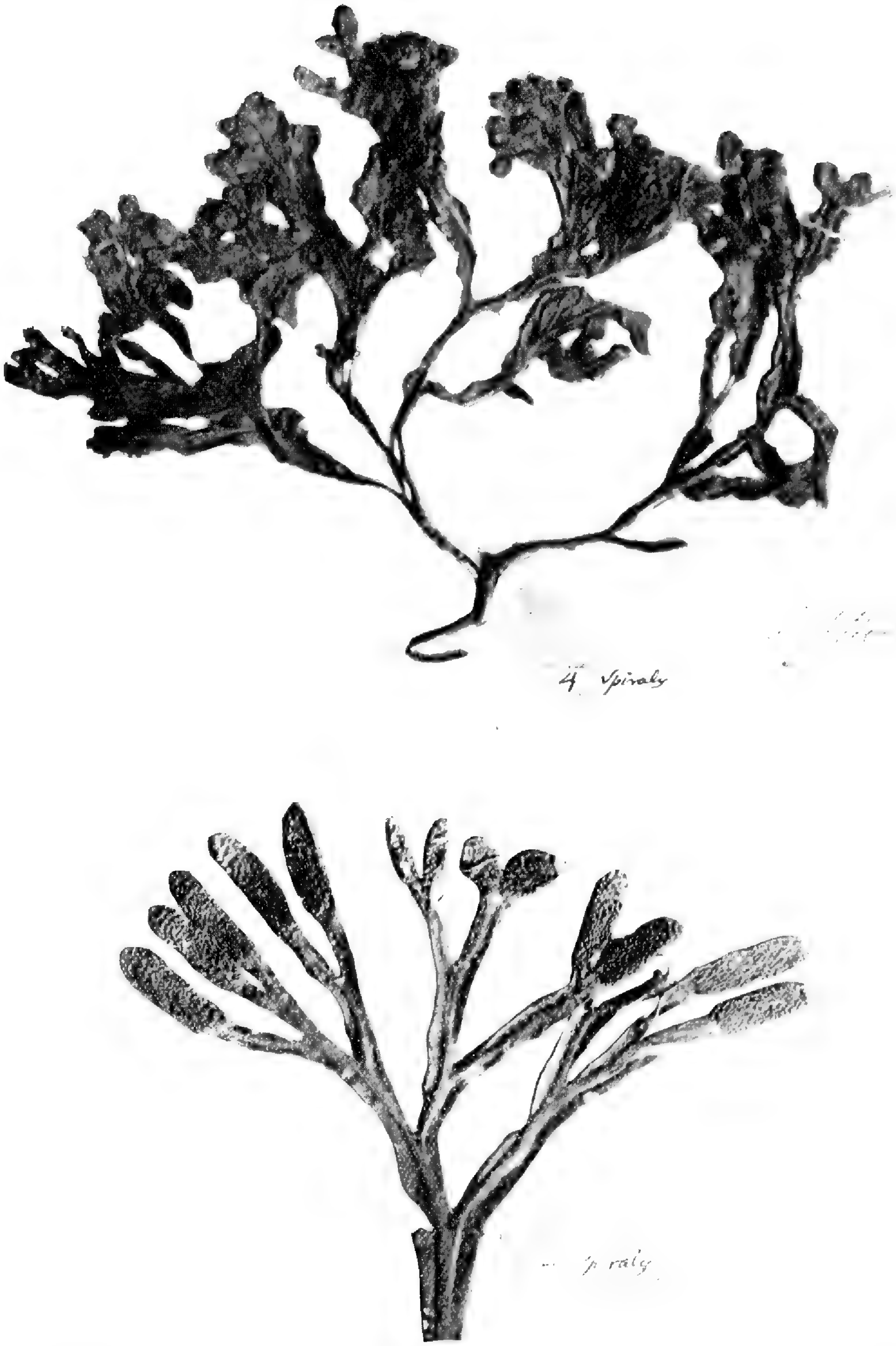
* Sauvageau, C., "Note préliminaire sur les algues marines du Golfe de Gascogne," p. 22 (Journal de Botanique, t. xi., 1897). As it seems to me to be of interest what Prof. Sauvageau writes here I shall quote the following. Prof. Sauvageau mentions firstly *Pelvetia canaliculata*: "au niveau supérieur de la marée," and continues: "Au-dessous, sont des *Fucus* d'un aspect particulier. Les frondes, dénudées à leur partie inférieure, ont au-dessus environ un centimètre de largeur et sont d'un brun rougeâtre; chacune se termine par un petit réceptacle hermaphrodite, globuleux, moins large qu'elle, sans la bordure marginale du *F. platycarpus*. Ces frondes sont tordues, font un ou deux tours de spire; elles ne possèdent pas de vésicules, mais des boursouflures, irrégulières dans leur forme et leur situation, de chaque côté de la nervure, comparables à celles du *F. ceranoides*. M. Rosenvinge a bien voulu m'écrire que ce *Fucus* de San Vicente correspond tout-à-fait au *F. platycarpus* qui vit à la limite supérieure de la mer sur les côtes de Danemark et dont les réceptacles sont tantôt un peu comprimés et marginés, tantôt presque sphériques et non marginés. Ce serait l'ancien *Fucus spiralis* de Linné." It is evident from this that Prof. Sauvageau at first was rather unfamiliar with this plant; it being so different from *Fucus platycarpus*, Thur. And furthermore, it also seems to me that Prof. Sauvageau's description of *Fucus spiralis* has some interest, as it, properly speaking, does not contain so very much more than Linné's description including remarks and quotations, with the exception that Prof. Sauvageau mentions that it is hermaphrodite.

† However, should there still be investigators who do not consider Linné's description sufficiently precise, then we can write, just as we do with *Fucus inflatus*, L., M. Vahl, *Fucus spiralis*, L., Lightfoot, as the description by Lightfoot is, as mentioned above, so good that there is no doubt as to its identity, but this seems to me quite unnecessary.

That we should be obliged to give up Linné's name and use Thuret's because this investigator has found one important character, not only of the plant in question, but also common to other species of *Fucus*, is really not allowable; strictly speaking, one could with just as good reason urge the impossibility of using the names of the other *Fucus*-species.


4 Spiralis
spiralis

P. F. Visick, photo. Grout, sc.

FUCUS SPIRALIS, herb. Linn.

else to do but to refer *Fucus platycarpus* as a variety of Linné's old species *Fucus spiralis*, L. We then not only agree with the adopted nomenclature-rules (*cfr.* Verhandlungen des intern. bot. Kongresses in Wien, 1905, Jena 1906), but it so fortunately happens that Linné's old species, var. *typica* as I call it, has by far the largest distribution; just to mention only one side of the Atlantic Sea, it occurs from the North Cape to the Canary Islands, while var. *platycarpa* mainly occurs on the Atlantic coast of France and in the Channel.

As to var. *limitanea* (Mont.), I shall, referring to Prof. Sauvageau's account (Bot. Færöes, p. 477), only emphasize that one ought to use Montagne's name for this dwarf form which, if it is the same as my forma *nana* from the coast of the Færöes, is due to the exposed locality, just as is forma *disticha* of *Fucus inflatus*; the size also of *Fucus spiralis* and of *Fucus inflatus* is also entirely dependent on this. As this dwarf form, at all events the Færöese one, differs in nothing else from var. *typica*, it ought to be referred as a forma *limitanea* of this variety.

Summing up shortly, I contend to have proved:—

(1) That we are able to form a sufficiently certain opinion as to the identity of *Fucus spiralis*, L.

(2) That we accordingly ought to write *Fucus spiralis*, L., as the name of the species, with the varieties:—

Var. *typica*, Börgs. (=f. *typica*, Börgs. l. c.), with f. *limitanea* (Mont.) =f. *nana*, Kjellm. (Börgs. l. c.); and

Var. *platycarpa* (Thur.), Börgs. l. c.

EXPLANATION OF PLATE 9.

Fucus spiralis, Linn.

The upper figure is reduced by nearly one-third from the Linnean type-specimen; the legend "4 spiralis" is in Linné's handwriting at the bottom of the sheet, close to which Sir J. E. Smith has written in pencil "Lightfoot's" [species], implying that Lightfoot's description in his 'Flora Scotica,' p. 911, suits this plant.

The lower figure is a portion also reduced by one-third from a second sheet pinned by Linné to the previous sheet; he has also written at the foot "4 spiralis," but this plant is regarded as quite distinct from the former, *cf.* p. 112.

The very dark hue of these *Fuci* has rendered their reproduction by photography very difficult; it will be seen that they are illuminated from the side, so as to emphasize difference in elevation.

The Dry-Rot of Potatoes. By SIBYL LONGMAN, Research Student in Botany, University College, Reading. (Communicated by Prof. F. KEEBLE, D.Sc., F.L.S.)

(PLATE **10**.)

[Read 18th March, 1909.]

I. INTRODUCTION.

THE objects with which this research was undertaken were :—

(1) To determine whether the fungus of dry-rot of potatoes (*Fusarium Solani*) is capable of inducing disease in the growing potato plant, as well as of setting up the well-known pathological condition in the stored tuber.

(2) To ascertain whether dry-rot can be induced in potato-tubers directly by inoculation with spores of *Fusarium Solani*, or whether, as is commonly supposed, dry-rot only follows upon wet-rot.

(3) To determine experimentally whether tubers infected by *F. Solani* can be sterilized by heat, *i. e.* whether the death-temperature of the fungus is higher or lower than that of the tuber.

With respect to (1) the conclusion is reached that *F. Solani* is a true parasite not only of the resting tuber but also of the growing potato-plant.

With respect to (2) it is shown that there is no necessary time-relation between an outbreak of dry-rot and one of wet-rot. Dry-rot may be induced by inoculating healthy potato-tubers with pure cultures of *F. Solani* spores.

These conclusions, arrived at independently, confirm those reached at an earlier date by Smith and Swingle and published in their memoir on the Dry-Rot of Potatoes ('04).

Among the other conclusions reached in this paper may be mentioned those relating to the systematic position of the fungus. Whilst reasons are given (p. 123) for assigning *Fusarium Solani* to a place among the Ascomycetous fungi, no support is offered to the claims of Massee ('04) that *F. Solani* possesses a definite ascus-stage.

II. THE SYMPTOMS OF THE DISEASE, AND THE LIFE-HISTORY OF *FUSARIUM SOLANI*.

Fusarium Solani causes the potato disease known as "dry-rot." In autumn, when potatoes are being harvested, a few may be seen already showing symptoms of dry-rot, but the disease is far more wide spread amongst stored potatoes; after Christmas, and, indeed, when the conditions of storage are defective, dry-rot may cause considerable loss. The earliest outward sign of the disease is the wrinkling of the skin as the potato shrinks. The wrinkles are often first seen round the place of infection, and spread from this point in more or less concentric rings until the whole tuber is dry and shrunken.

Before the potato begins to wrinkle, however, changes take place within. The presence of the fungus inside the tuber is shown by a brown staining, which appears in the vascular bundles and spreads into the flesh, which then begins to dry and shrink, and becomes powdery owing to the fungus leaving the starch untouched.

If the fungus has not killed the whole potato before the spring, the eyes on the sound parts may sprout in a normal way; but as soon as the disease reaches the shoots their stems shrink at the base, their leaflets blacken, and the shoots die.

The fungus in some cases does not break through the skin of the potato until it is covered with wrinkles, but in other cases the fungus appears on the surface of the potato at a comparatively early stage.

It appears on the surface of the potato either in white patches (often covering wounds) or else in the form of small pustules breaking through the skin at the place where it first wrinkled. As the wrinkling progresses the pustules increase in number; but they never appear on the sound part nor within 1 cm. of the margin of the wrinkled part of the potato. Saprophytic fungi often follow on the dead part of the potato amongst the oldest pustules, but they never mix with the younger ones nor precede them. At Reading, by far the commonest saprophyte following thus in the wake of *F. Solani* was a species of *Monosporium*.

Phases in the Development of Fusarium.

The mycelium is septate and much branched, and varies a good deal at different stages of growth in colour, thickness, and number of transverse septa. The hyphæ sometimes intertwine, forming rope-like strands. Such strands occur both in cultures growing on living potatoes and also on chunks of sterilized potato in Buchner-tubes. The first spores to appear, whether borne on patches of mycelium or in pustules, are the typical *Fusarium* spores, although on young mycelium they are often poorly developed. The typical spores are transparent, colourless, and usually sickle-shaped though occasionally spindle-shaped, with 0–7 transverse walls. The spores are very variable in size; the average of 160 measured being $35\,\mu$.

On mature mycelium, spores having three transverse walls are the commonest; but young mycelium often produces smaller spores with one transverse wall or none. Since, however, all transitions from aseptate to 7-septate forms occur, the aseptate spores cannot be considered to belong to a type distinct from those with septa (see Pl. **10**, A).

On potatoes attacked by dry-rot two types of pustules are frequently produced. The simplest consists merely of small tufts of hyphæ bearing typical *Fusarium* spores, and these pustules, though sometimes pink, are usually white or buff-coloured. In the second type the spores are enclosed in a thin wall of closely-interwoven hyphæ. The pustule-wall is sometimes buff, but more often pink in colour (Pl. **10**, D).

The walls of some pustules have no opening, but others have a small circular orifice near the apex, and may thus be regarded as pycnidia. If a pustule of the latter kind is mounted in a drop of water, masses of the typical *Fusarium* spores are ejected through the circular opening at the apex of the pycnidium, and by their swelling, rupture its walls.

As the pustules get older they lose their somewhat hemispherical and regular form, and give place ultimately to mere spore-bearing patches of mycelium. In some cases, before they have lost their shape the hyphæ at the base of such patches turn dark blue and become very closely interwoven, thus forming a hard, dry sclerotium. Meanwhile the upper part turns bright blue, and two different types of spore appear.

The spores of the first type resemble the typical *Fusarium* spores in shape, but contain one or several round refractive bodies, situated either towards the end or in the middle of the spores (Pl. **10**, B).

The spores of the second type resemble somewhat the round bodies included in the spores of the first type, but are borne directly on the mycelium, either singly or in groups of two or three. In some cases the spores do not remain round, but become more or less pointed at the apex (Pl. **10**, C).

The spores of the first type remain viable for years. Thus spores of a blue culture made in 1905 and allowed to dry up, grew freely when planted out in 1908, giving rise again to a blue culture.

The period of viability of the blue *Fusarium* spores of Type II. has not been tested.

The resting spores when dry are capable of resisting a fairly high temperature, withstanding 64·5° C. for 10 hours. When wet they are readily killed at 50° C.

It has been seen that *Fusarium Solani* varies a great deal in form and colour. All the variations already described are to be met with in the fungus growing on living potato ; and with the exception of the pustules, which were only found breaking through the skin of potatoes, they occur also in cultures growing on sterilized potato.

The different colours of the fungus therefore appear, like the different types of spores, to mark stages in its development rather than to be caused by any external condition such as the medium in which the fungus grows, unless, indeed, they are due to chemical changes in the medium caused by the fungus itself.

This conclusion is in disagreement with that of Smith and Swingle ('04), who find that "the form, colour, and habits of growth of this fungus depend much on the medium in which it is grown."

The colours found by these authors and by myself were in most cases the same, but whereas I have not seen the lilac, violet, and purple shades that they describe, they do not get the shades of light and dark blue commonly found at Reading.

Smith and Swingle obtained the purple shades in ***Fusarium*** growing on the following media :—

Boiled rice, lilac (also pink and white). Silicate jelly, lilac (also pink, rose, and salmon). Boiled corn, purple (also pink and white). Boiled tapioca, deep violet (also white). Whereas I have obtained white, buff, pink, and light and dark blue, all in one and the same medium, viz. potato.

Fusarium Solani has been placed among the lowest of the Fungi imperfecti, in the Hyphomycetes. It would appear from the pycnidial nature of the pustule that it should rather be placed in the highest group, viz. the Sphæropsidales (Lindau, '00).

By reason of the pycnidia, the fleshy and waxy stroma and the hyaline spores, it falls into the Nectrioidaceæ, sub-division Zythieæ ; and by its spindle-shaped spores and general characteristics of stroma (being brightly coloured, etc.) it may be placed in *Aschersonia*.

It is not unlikely that in an appropriate medium *F. Solani* might be induced to form ascus-fruits, and so show itself to be a typical ascomycete. In this connection it may be noted that Massee ('04) claims to have observed typical ascus-fruits succeeding the conidial stage. As this is a matter of some importance, a brief account of Massee's statements may be given.

This author finds that in its first stage ***F. Solani***, or, as he prefers to name it, *Nectria Solani* (Pers.), forms spores of the Monosporium type. He may have regarded as "Monosporium" spores the young, aseptate, but undoubted ***Fusarium*** spores which it has been shown can be connected up by transition forms with the typical ***Fusarium*** spores. In any case no Monosporium stage was found on the pure cultures of the fungus grown at Reading.

The second stage described by Massee, in which the fungus changes from white to pink, and the typical *Fusarium* spores are produced, exactly corresponds to that described in the foregoing pages. Massee further states that the typical spores yield a third type of spore produced in ball-like masses of gelatine (the Cephalosporium stage). In no case amongst the many germinations of spores watched in the course of this research, was this Cephalosporium type of spore obtained. In every case from each spore there pushed one, or frequently several germ-tubes. The germ-tubes soon branched and gave rise to the ordinary mycelium, which in its turn bore the usual typical spores.

Massee finally states that after a long time blood-red flask-shaped bodies appear on dried up bits of skin that have been exposed to the open air. These fructifications he depicts as typical perithecia, each bearing a number of asci, and each ascus containing eight spores. No such fruits have been met with during this investigation, and that although the fungus has been kept under observation for several years. The last stages in the development of the *Fusarium* watched at Reading consist either in the pink pustules containing the typical *Fusarium* spores, or else in the blue mycelium, with its two peculiar types of spores.

III. PARASITISM OF *FUSARIUM.*

It has been thought that dry-rot is always preceded by wet-rot, but this is not the case. *F. Solani* may infect tubers that have previously been attacked by wet-rot, but it is also quite capable of attacking healthy tubers. This was proved during the autumn and winter of 1907, when many healthy tubers were inoculated with the spores of *F. Solani*, with the result that the symptoms of the disease made their appearance in them.

Smith and Swingle ('04) have shown that the disease also invades the growing plant, and this my experiments confirm. They state that the fungus ordinarily enters the plant by the roots, and slowly spreads through all the underground parts of the plant. As the roots die the stems fall over, and the leaves and upper parts of the shoot wilt. Although the mycelium spreads throughout the root system, few or no hyphæ are found at the ground level, and as a rule, the brown staining only penetrates for a few centimetres above ground.

During the summer of 1907 many of the potato plants grown for the purposes of these experiments in the ground neighbouring the Botanical Laboratory at University College, Reading, were attacked by *Fusarium*. The infected plants resembled in most particulars those described by Smith and Swingle, but differed from them in the following respects:—

I. When the shoots began to wither the lowest, and not the uppermost, leaves were the first to become black and die; the stems also died from below upwards.

II. The brown staining frequently spread about half way up the stem, although it was never found in advance of the highest dead leaf.

III. In some cases the stems died at the same time as the leaves, but in others they remained green and standing for some time after the leaves were dead.

IV. The stems did not fall down until some time after they were quite dead, but, as they were very shrunken at the base, this was probably owing to their having been very thoroughly earthed up.

Smith and Swingle ('04) give a figure showing the distribution of disease in their plots at a certain date (July 27th). The distribution is curious as the disease does not appear to have spread from a centre of infection, but diseased plants appear scattered singly or in small groups throughout the plots. In many cases not all the shoots from one "seed-potato" were attacked ; some remained perfectly healthy after others had been killed.

The distribution of the disease in the Reading plots, on August 1st, 1907, was strikingly like that described by these authors.

The potatoes at Reading were grown on a freshly broken pasture, to which no manure had been added, and which was therefore thought to be free from disease. The seed-potatoes also appeared to be free from disease up to the time of planting.

Some of the Reading plots were planned for spraying experiments, and were sprayed with "Bordeaux mixture" during the summer. Other plots were devoted to Infection Experiments: some of the seed-potatoes of one plot and the ground of another plot being inoculated with blue *Fusarium* at the time of planting.

On August 1st diseased plants appeared to be evenly distributed throughout all the plots, even the plants from the inoculated seed-potatoes showing no higher percentage of disease than those from the uninoculated, sprayed or control plots.

What the source of infection is, is unknown. It would be natural to suppose that the fungus gains an entrance into the sprouting tuber or the damaged root from the soil. But the occurrence of the disease in plants grown on a freshly broken pasture which had not borne a potato-crop for many years, suggests either that the fungus has a wide-spread saprophytic existence in the soil or that it is commonly present in the potatoes themselves. Bernard ('02) has made the interesting suggestion that the tuber of the potato is itself a hypertrophy due to the irritant action of *Fusarium*. Without claiming the results of the Reading experiments as confirming this hardy hypothesis, they would seem to offer some slight support thereto.

On this view, a nicely balanced struggle between fungus and potato results in a healthy tuber, whereas the balance, slightly disturbed in favour of the fungus, results in the diseased plant. In any case *F. Solani* appears to be a somewhat erratic parasite and often incapable of infecting actively growing potatoes, although, as has already been shown, it attacks the stored and dormant tubers with much greater ease.

IV. Heating Experiments.

Since the fungus of dry-rot is of frequent occurrence in potato tubers and since, as shown by these investigations and by those of Smith and Swingle, it not only sets up pathological conditions in the tuber but also attacks the aerial shoots, it was evidently useful to ascertain whether tubers could be sterilized with respect to the fungus by means of heat. To this end a series of experiments were made of which Tables I. & II. are summaries.

In the first series (Table I.) batches of infected tubers were heated in tins up to certain temperatures and the effects on the tuber and on the fungus determined subsequently by cultivation-tests.

A Hearson incubator was used in these experiments, and the temperature of the potatoes determined in each case by means of a thermometer inserted into the middle of a tuber. It was found that when tins containing each five tubers were used, it took 7 hours for the potato-thermometer to read the temperature recorded by the incubator-thermometer. The records in Table I. (2) were obtained by heating batches of tubers during one day until the temperature of the potato-thermometer corresponded to that of the incubator-thermometer; allowing the tubers to cool for one day and then reheating them again on the third day.

Table I. (1) shows that when the tubers were heated gradually till they attained a temperature of 53·5° C. neither potato nor fungus was damaged; but that when heated up to 57·2° C. the fungus was uninjured though some potatoes were killed.

Table I. (2) gives the results of intermittent heating. Under these circumstances the tubers failed to withstand heating up to 54·5° C. whereas the fungus withstood this treatment. Table I. (3) records the results of heating infected tubers up to certain temperatures and of maintaining them for 10 hours at these temperatures. As will be seen from the Table, exposure for 10 hours at a temperature of 49·5° C. is fatal neither to tuber nor fungus; exposure for a like time to 50·5° C. suffices to kill the tuber but not the fungus.

A second series of experiments (Table II., p. 128) was made in order to determine the heat-resistance of the fungus in dry, moist, and wet conditions. As was to be expected, the fungus in a dry state (blue sclerotium) proved most resistant, withstanding a temperature of 64·5° C. for 10 hours. A moist culture was killed when allowed twice to reach a temperature of 50° C., and a wet culture (in a Buchner-tube with water) if it once reached 50° C. Hence the heat-resistance of the fungus in the living potato is greater than that of a moist culture on sterilized slabs of potato.

The experiments lead to the conclusion that the method of heat-sterilization employed successfully in various cases of "seed" infection, such as barley infected with smut (Heald '08), is useless in the case of dry-rot.

TABLE I.—*Heating Experiments.*

(+) signifies living. (−) signifies dead.

		Temp. Centigrade.		Effect of Temperature.	
				on Potato.	on *Fusarium*.
I (1).	Infected tubers heating gradually during 1 day up to :→	41·5°		(+)	(+)
		42·5		(+)	(+)
		51		(+)	(+)
		52		(+)	(+)
		53·5		(+)	(+)
		57·2		some alive	(+)
		61		(−)	(+)
		64·5		(−)	(+?)
		1st day.	3rd day.		
I (2).	Infected tubers intermittently heated, viz.: 1st day up to :→ 3rd day up to :→	51·5	49·5	(+)	(+)
		50	50·5	(+)	(+)
		51·7	50	(+)	(+)
		52	52·5	(+)	(+)
		51	53	(+)	(+)
		54·5	53·5	(+)	(+)
		54·5	54·5	(−)	(+)
I (3).	Infected tubers heated for 10 hours at Temp. :→	43		(+)	(+)
		49		(+)	(+)
		50·5		(−)	(+)
		51·5		(−)	(+)
		54·5		(−)	(+)
		55		−)	(+)

TABLE II.

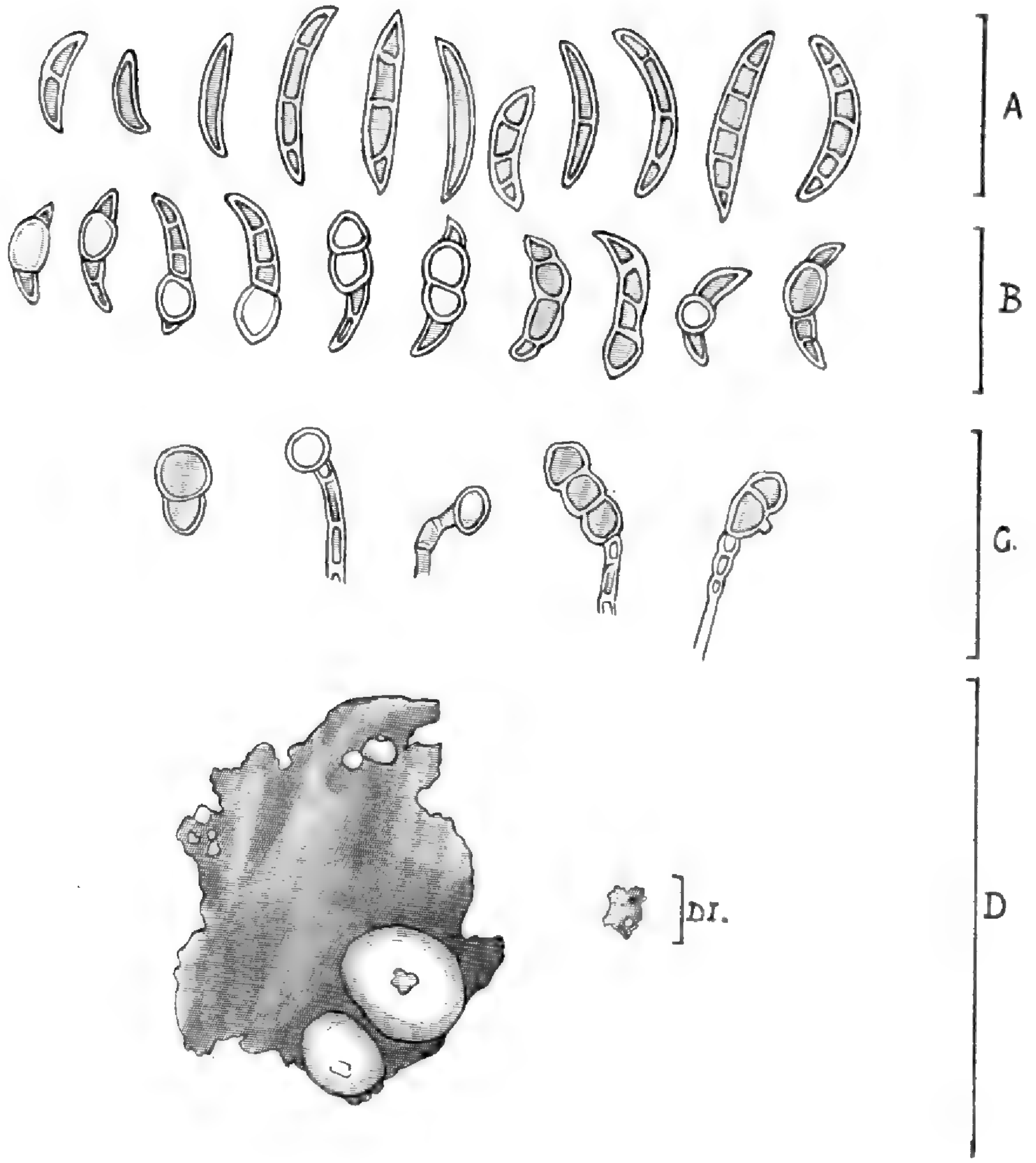
Effect of Temperature on Cultures of Fusarium *in dry, moist, and wet states.*

(+) = Culture not killed. (−) = Culture killed.

Cultures heated gradually during 1 day up to	..	50° C.	54·5° C.	58·5° C.	..	64·5° C.
State of culture Dry	..	(+)	(+)	(+)	..	(+)
Moist ..	..	(+)	(−)	(−)		
Wet....	..	(−)	(−)	(−)		
Cultures heated intermittently for 1st and 3rd days up to	..	50° C.	54·5° C.	..	60° C.	64·5° C.
State of culture Dry	..	(+)	(+)	..	(+)	(+)
Moist ..	..	(−)	(−)	..	(−)	
Wet....	..	(−)	(−)	..	(−)	
Cultures heated for 10 hrs. at temp.	45·5° C.	50 C.	54·5° C.	..	60° C.	64·5° C.
State of culture Dry	(+)	(+)	(+)	..	(+)	(+)
Moist ..	(+)	(−)	(−)	..	(−)	
Wet....	(+)	(−)	(−)	..	(−)	

SUMMARY.

1. *Fusarium Solani* is a true parasite capable of destroying the tuber of the potato and also of killing the aerial shoots.
2. The fungus has a reduced pycnidial stage, but Massee's ascus-stage has not been met with.



S. L. del.

Grout, sc.

THE DRY-ROT OF POTATOES

3. The colour-phases of mycelium and spores appear to be associated with stages in the life-history of the fungus and not, as Smith and Swingle suggest, with the nature of the culture-medium.
4. Sterilization of tubers by heat is not possible since the death-temperature of the fungus is higher than that of the potato.

In conclusion I desire to express my thanks to Messrs. Sutton for their kindness in providing the large quantity of healthy potatoes ("Abundance") used in the course of these experiments; and to Professor Keeble, in whose laboratory the work was carried on, for the help and advice which he has given me whilst this enquiry was in progress.

Literature referred to in the Text.

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('00) LINDAU.—Fungi Imperfecti (Hyphomycetes). Engler & Prantl, Nat. Pflanzen-Fam., I Teil, i. Abt.** pp. 415–517, 1900.

('02) BERNARD, NOËL.—Rev. Gén. de Bot., t. xiv., 1902, pp. 5–25, 58–71, 101–119, 139–154, 170–183, 269–279.

('04) SMITH, E. F., & D. B. SWINGLE.—The Dry-Rot of Potatoes due to *Fusarium oxysporum*. U.S.A. Dept. of Agric., Bur. Pl. Indust. Bull. no. 55, 1904. (With lists of the more important references up to 1904.)

('04) MASSEE, G.—Some Diseases of the Potato. Journ. R. H. S., Dec. 1904.

('08) HEALD, F. D.—Seed treatment for the Smuts of Winter-barley. Report Agric. Exp. Stat. Univ. Nebraska, Jan. 1908.

EXPLANATION OF PLATE 10.

A. Spores of *Fusarium Solani*, showing aseptate and septate forms.
B. Spores of the first type, p. 122, containing refractive bodies.
C. Spores of the second type, *l.c.*, directly borne upon the mycelium.
D. Pustules of Dry-rot, × 7; DI, the same, natural size.

A Contribution to the Montane Flora of Fiji (including Cryptogams), with Ecological Notes. By Lilian S. Gibbs, F.L.S.

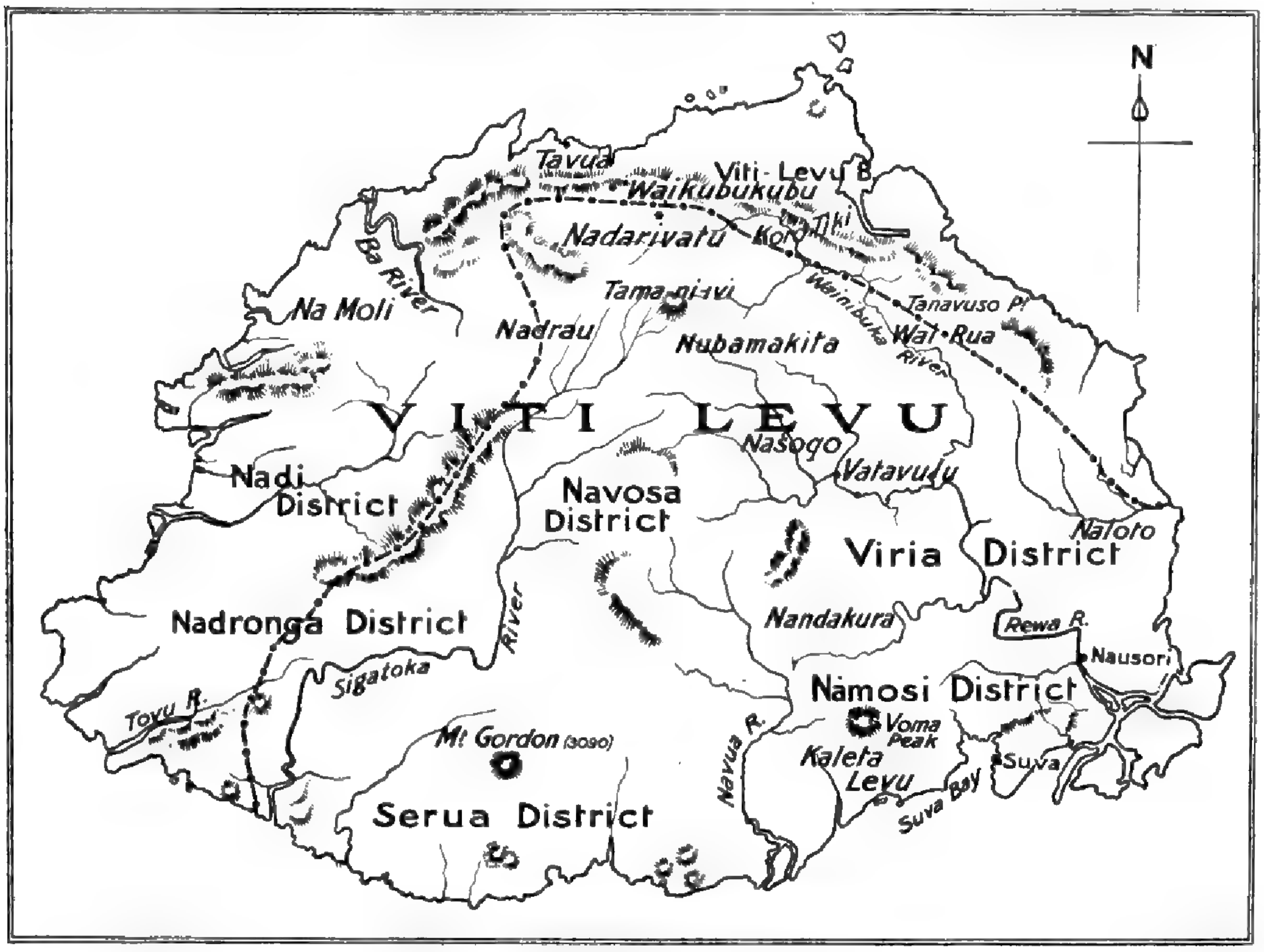
[Read 4th March, 1909.]

(Plates **11-16**, Map and Text-fig.)

The Fijian Archipelago is situated in the South-Western Pacific, between 176° East longitude and 178° West longitude and between 16° and 21° South latitude.

The group consists of about 200 islands only 80 of which are inhabited, the total surface occupying about 7450 square miles.

Viti Levu, the largest island, has a length of 85 miles and a maximum breadth of 60 miles, and is about 4100 square miles in area. It is a magnificent island of continental configuration, with a series of forest-clad mountain ranges which culminate in Mt. Victoria (Tama ni ivi), 4000 ft. in height *. These ranges are intersected by many fine rivers, the largest of which are the Rewa, navigable for about 50 miles and, with its branches, having a total length of 200 miles, and the Sigatoko, which takes a south-westerly course across the island.


N
Tavua
Viti-Levu B.
Waikubukubu
Nadarivatu
Koro
Tiki
Ba River
Na Moli
Nadrau
Tama-ni-ivi
Wainibuka River
Tanavuso Pt
Wai-Rua
Nubamakita
VITI LEVU
Nasogo
Vatavulu
Nadi District
Navosa District
Viria District
Natoto
Nadronga District
River
Nandakura
Rewa R.
Nausori
Sigatoka
Namosi District
Toyu R.
Voma Peak
Mt Gordon (3090)
Kaleta Levu
Suva
Navua R.
Suva Bay
Serua District

---

* Given as 4500 ft. in the Admiralty Chart. Mr. A. Joske informed me that the latest measurements had corrected the altitude to 4000 ft.

Both these rivers rise in the Mt. Victoria range, which forms the watershed. This range is situated, as will be seen from the map *, in the extreme north-west of the island. To the windward or S.E. portion, which includes the major part, the rainfall is very great and the vegetation of tropical luxuriance; whilst the N.W. or leeward side receives drying winds, the moisture of the S.E. trade being condensed by the ranges of mountains crowned by Mt. Victoria. This dry country forms a narrow belt on the north, but widens out considerably on the western side. It is undulating, rising to high ridges in parts, and for several months of the year receives next to no rainfall. Trees occur in the soak areas on the mountain-slopes, and fringe the streams. Otherwise this country is chiefly reed-covered (*Miscanthus japonicus*, Anderss.).

Of the chief botanical collections made in Fiji, the first was by Hinds and Barclay in 1840, who accompanied Sir Edward Belcher in H.M.S. 'Sulphur.' Brackenridge, Rich, and Pickering, botanists to the United States Exploring Expedition under Captain Wilkes, which touched at the islands in 1840, made important collections, the results of which were published by Asa Gray in his splendid work, 'The Botany of Wilkes' U.S. Exploring Expedition.'

In 1856 Milne, who was attached as naturalist to H.M.S. 'Herald,' under Captain Denham, collected in the islands, which at about this time were also visited by Professor Harvey of Dublin for the same purpose. The most important work, however, was done by Dr. Seemann in 1860–61, who, as botanist, accompanied a Government Mission sent from England to Fiji to report on the advisability of annexation. Seemann visited many districts in both Viti and Vanua Levu and a number of the smaller islands, and succeeding botanists owe him a great debt of gratitude for the admirable way in which he embodied his own results and those of all previous collections in the 'Flora Vitiensis.' Dr. Eduard Graeffe, a zoologist, visited Viti Levu in 1862, and collected many plants which were included in Seemann's 'Flora.' In 1877 Horne, then Director of the Botanic Gardens at Mauritius, spent a year in the country collecting, at the invitation of the Governor, Sir Arthur Gordon.

More recently, Sir J. B. Thurston made several small collections, while Governor of the Islands; and the present Governor, Sir Everard im Thurn, whose work of exploration and botanical collections in British Guiana are well known, has collected largely during his tenure of office, especially orchids and ferns, in which he is chiefly interested. The publication of his results will be awaited with interest in the botanical world.

Previous collectors having chiefly explored the coasts of the different islands, the actual montane species known were limited to those found by Seemann and Horne on Voma Peak in Viti Levu, under 4000 ft. high, and by Seemann, Graeffe, and Storck on Buke Levu, 2500 ft., the highest point on the island of Kadavu. It was therefore my object while in Fiji only to work above a certain altitude, and so cut out the widely distributed Indo-Malayan littoral flora and what one may call the ethnobotanical element, both more or less common to all the Polynesian islands. Through the kindness of the Governor, I was enabled to carry out this idea by spending most of the spring months of August, September, and October at Nadarivatu, 2900 ft. in altitude, on the northern slopes of the Mt. Victoria range, a small police-station and the highest inhabited point in Fiji.

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* The dotted line roughly indicates the limits of the forest-clad S.E. region. The mountain ranges of the interior have been omitted.

Sir Everard im Thurn not only facilitated my journey across the island from Suva, but by lending me official quarters at Nadarivatu gave me full opportunity to work the neighbourhood from a botanical point of view. Nadarivatu, besides being the residence of the Governor, who comes up from Suva for two months during the rainy season, is also that of Mr. Adolf Joske, the Resident Commissioner for Colo North; and these two houses, with the Stone Cottage, which was lent to me, comprised the only available accommodation there at the time of my visit.

Mr. Adolf Joske, having kept a complete series of temperature and rainfall observations since 1901, very kindly placed his results at my disposal. The following is the rainfall table for seven years (p. 133). The variation in this table is so great that it is necessary to quote the series of years. The temperature is only given for 1907, the year of my visit.

It will be seen from the table that there is a well-marked dry season during the months of July, August, and September, and the early part of October. This holds for the whole of Fiji. The summer is the rainy season, which lasts from the middle of October till May. In the lower parts of the islands the damp heat is intense and very enervating. At Nadarivatu, owing to its elevation, the temperature does not vary much; but this fact is compensated for in summer by excess of moisture from mountain mists, as it lies on a small plateau only 900 feet below the cloud-topped ridges of the encircling mountains. In spring the temperature is delightful, and there is very little mist or rain. The evenings, however, are always chilly, necessitating fires all the year round.

There is very little exposed rock-surface in Fiji. The principal formation is red volcanic clay of great depth, of which even the narrow wooded ridges, so characteristic of all the higher mountains, are formed. The rock is chiefly volcanic agglomerate, which, where exposed, weathers quickly and is reduced to huge blocks, which are especially frequent on the dry side of the island. Columnar basalt is general; granite and diorite also occur largely in certain areas. Whether these plutonic rocks were present *in situ* was a point which had aroused the interest of geologists, from its bearing on the possible continental origin of Fiji.

Dr. Woolnough (**13**) of Sydney University, who spent some weeks in Viti

RAINFALL.—NADARIVATU, FIJI, 2700 feet.

Year.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	
1901	54·50	49·95	18·84	3·75	6·57	1·21	2·45	2·38	3·31	1·19	9·69	9·48	163·32
1902	19·16	34·95	13·18	13·12	12·33	1·47	3·46	8·07	7·64	2·14	5·15	6·94	127·61
1903	8·77	5·69	4·35	2·04	0·47	0·49	2·49	6·38	1·80	7·12	6·21	20·57	66·38
1904	61·72	28·67	42·68	15·18	11·23	10·79	5·8	3·26	5·64	9·56	0·91	8·89	204·33
1905	16·59	13·87	23·35	5·47	2·88	1·15	1·90	3·85	0·05	2·07	1·72	7·73	80·63
1906	11·45	6·71	33·76	16·19	2·38	2·79	6·45	5·60	2·75	3·98	9·37	28·94	130·37
1907	40·64	27·46	17·44	7·76	5·88	3·93	4·25	1·47	1·05	5·10	11·50	9·25	135·83

TEMPERATURE.

1907 ...	76°·6	76°·57	76°·07	75°·1	70°·0	69°·3	69°·03	68°·81	70°·17	74°·14	74°·0	75°·2	Mean max. temp.
„	63·9	69·71	63·07	63·82	58·5	55·0	54·93	51·69	53·5	59·13	61·0	62·83	Mean min. temp.

Highest max. temperature for any 24 hours, 82° on January 3rd.
Lowest min. temperature for any 24 hours, 43° on August 12th.

Levu in 1901 to investigate this question, divides the geological formations of the island into two main groups: the *first* including continental rocks of high but undetermined geological age; the *second*, Tertiary to recent formations of volcanic and sedimentary origin. Dr. Woolnough considers that Viti Levu consists of a core of very ancient, perhaps archaic rock, surrounded and partially covered by marine deposits of Tertiary and recent age, and Cainozoic lavas; but so far no traces of Palæozoic or Mesozoic formations have been observed. He accounts for the absence of these formations by a prolonged subsidence since very early geological time. He admits that there is no direct evidence up to the present to prove a continental origin for Viti Levu, and he states that the rocks collected by him show no marked similarity with either New Caledonia or New Zealand, the nearest undoubted continental areas. Also rocks characteristic of continental areas have nowhere been met with so far from land-masses. The great depth and extent of the ocean between Fiji and the nearest areas of continental land is also an argument against such origin. The latter difficulty is not considered insuperable, and the case of Madagascar is cited amongst others—the Mozambique Channel, due to extensive faulting, being quite as deep, though not so broad, as the sea which separates New Caledonia and Fiji. Other arguments are brought forward to prove the possibility of such continental origin.

Professor Woolnough notes the interesting fact that evidence afforded by land-shells is more towards affinity with the New Hebrides to the west, than with Samoa and Tonga on the east.

The botanical evidence, as far as it goes, shows no such preponderating influence. The flora is markedly Indo-Malayan, which the low altitude of the mountain ranges and the small area of open country practically restrict to forest types. In mosses and liverworts the affinity would apparently lie more with Samoa, but these plants have been systematically collected in Fiji and Samoa, which, as far as I know, has not been the case in other Pacific areas.

That it is inadvisable in the present imperfect state of our knowledge of the flora of these groups, to draw any far-reaching conclusions as to the distribution or endemism of particular genera or species, is proved by the results of the present collection. It was made in one locality, within a radius of 20 miles, and an altitudinal range of only 1300 feet, starting from 2700; yet it includes 40 new species and 7 new records, comprising 7 genera not previously recorded for the islands.

Of the new records the most interesting is *Melicytus ramiflorus*, widely spread in New Zealand, and also known from the Kermadec and Norfolk Islands and Tonga. *Cyrtandra glabrata* has previously only been recorded from Tahiti. *Podocarpus elatus*, growing as a slender tree in the forest, and one of the chief denizens of the mountain ridges about Nadarivatu, is known from

New South Wales, Queensland, and New Caledonia, and adds a fifth to the four members of the family already found in the Archipelago. The Indo-Malayan element is represented among the new records by *Elatostema sessile*, and in ferns by *Trichomanes peltatum* and *Botrychium daucifolium*, all widely spread in the Pacific, and recorded from Samoa. The universal *Lycopodium clavatum*, abundant on dry open hillsides about Nadarivatu, also occurs in Samoa.

Of the new species, the most interesting are the large-flowered *Elæocarpus Kambi* (a handsome forest tree), two species of *Polyscias* and one of *Plerandra*, and *Discocalyx fusca*, very near the Tongan *D. Listeri*. In Piperaceæ, *Piper* and *Peperomia* are well represented in Malaya, but only four species of the former and two of the latter were known from Fiji. I was much struck by the important part played by species of *Piper* in the undergrowth of the forest, and attempted to collect the various varieties, all of which were then in flower. Eight were obtained, of which M. C. de Candolle, who very kindly worked them out, found five to be very well-defined new species, *P. Gibbsiæ* and *P. oxycarpum* being interesting from their hairy ovaries—a very rare character in the genus. In *Peperomia*, of the seven species collected, all proved new; *P. Gibbsiæ*, *P. flavida*, and *P. lasiostigma* are particularly marked by their spikes being inserted in the axils of imperfect leaves—a point shown in two other species recently received by him from New Guinea, which otherwise entirely differ from the above.

In Orchids, out of 17 collected 9 were new, and of these, three, viz. *Phreatia vitiensis*, *Glomera Gibbsiæ*, and *Anæctochilus vitiensis*, are in genera new for Fiji. This result can in no wise be considered a representative one, for Sir Everard im Thurn informed me that the late summer months was the Orchid flowering-season, and exceptionally few bloom in the spring.

In contrast with the other new species, in which, with two exceptions, the affinity is Indo-Malayan, these Fijian Orchids, Mr. Rolfe informs me, show a deviation from their congeners. They belong to Malayan genera, but show peculiar specialization on lines not apparent in the other Pacific regions.

In the Mosses the affinity, so far as we know, is chiefly Samoan, though a few extend to New Caledonia, the New Hebrides, and E. Australia. Graeffe made large collections of mosses and liverworts in Fiji and Samoa, and many of my species are identical with his. In liverworts, *Treubia bracteata* is an interesting record. Originally discovered by Goebel in Java, this magnificent genus is common in the northern portion of the North Island of New Zealand, and the above species is recorded by Reinecke* for Samoa. *Dendroceros javanicus*, of Malayan distribution, and known from Tahiti and the

---

* Reinecke, F., "Die Flora der Samoa-Inseln," Engl. Bot. Jahrb. xxiii. (1897) pp. 237–368, t. 4–5.

Marquesas, was also found; but it is not given for Samoa in Reinecke's paper, where Stephani enumerates all the species collected in those islands, of which many are identical with the Fijian.

In Fungi, Miss A. Lorrain Smith has described three new species, two being in the little-known genus of *Laschia* and one in *Lentinus*.

From these results it will be seen that the present collection confirms the Indo-Malayan character of the Fijian Flora, and at the same time emphasizes its relationship to the islands to the east, viz. Samoa and Tonga, and to a less extent Tahiti—a fact already noted by Hemsley *. There is one point that analyses of different collections bring out very clearly, and that is, the relation of the flora to the topographical character of the various islands. Fiji with its large islands, mountain ranges, fine rivers, and fertile depth of soil, harbours, as might be expected, a larger and more varied flora than Samoa, where the islands are smaller in area, Upolu having only one mountain range, which is the watershed, whence the streams pour down its sides to the surrounding ocean. Climatic conditions being practically the same, the predominating features of the vegetation agree, but the magnificent Conifers of Fiji are absent, restricted topographical conditions not allowing their development. The Tongan Islands are of coral formation, perfectly flat, Tongatabu and Haarpai being practically all over in a state of cultivation, and even the smallest islands are planted with coconuts. Eua is the one exception : standing out like one mountain from the rest of the group, 1000 ft. in height, with a volcanic soil and heavy rainfall, it has a much greater number of species approximating strikingly to Fiji, as shown in the presence of *Melicytus ramiflorus* and *Discocalyx Listeri*. The Vavau group is composed of raised coral-reefs, the highest point being 400 ft. † Having no rivers, these islands depend on the excessive rainfall for their water-supply. Their flora is characterized by the drier types of Fiji, and the generally distributed ethno-botanical plants with the usual Indo-Malayan ferns. In the Cook Islands, more to the south, the flora of Rarotonga has been thoroughly investigated by Cheeseman ‡ ; there the area is small, the greatest altitude 2200 feet, and the streams radiating from the mountains do not open out into rivers but lose themselves in the sandy beach round, which allows of no mangrove formation. The island was generally cultivated, as it formerly carried a much larger population; so that the ethno-botanical plants of Polynesia are well represented, with the widely distributed plants of drier areas, and a restricted number of endemic types.

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* Hemsley, W. B., "The Flora of the Tonga or Friendly Islands," Journ. Linn. Soc., Bot. xxx. (1894) pp. 158–217.

† Burkill, I. H., "The Flora of Vavau," Journ. Linn. Soc., Bot. xxxv. (1901) pp. 20–65.

‡ Cheeseman, T. F., "The Flora of Rarotonga, the chief island of the Cook Group," Trans. Linn. Soc. ser. 2, Bot. vi. (1903) pp. 261–313, t. 31–35.

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The trees, according to Mr. Cheeseman's description, are not comparable to those of Fiji, and the predominance of a Composite like *Fitchia speciosa*, Cheesm., points to a poorer and shallower soil.

Some emphasis has been laid on the agency of birds in the distribution of plants to the Pacific Islands. Warming*, however, has effectively dealt with that question in relation to the Faeroes, and his pertinent remarks are equally applicable in the present case. He quotes the interesting result arrived at by Danish investigators, viz., that migratory birds travel on empty stomachs (p. 676). For a series of years thousands of birds picked up dead at the Danish lighthouses have been sent to the Zoological Museum at Copenhagen, and notes on these birds have been published annually by H. Winge, who only found slight traces of food in the stomachs, in the shape of small pieces of the testa of seeds &c., and in some cases a little sand or small stones, nor were any seeds found adhering to the feathers, beaks, or feet. In the face of this evidence, the power of birds to carry seeds appears to be limited to those shot near their native haunts. Warming, after citing evidence to prove the immense distance seeds can be carried by other agencies, concludes that winds are the chief agency in distributing seeds to Island groups. Their influence is shown in the present case by the spread of *Æcidium Balansæ* to *Agathis vitiensis.* First discovered in New Caledonia on *Agathis ovata*, it has now reached Fiji, where it is probably of recent occurrence, as the previous able collectors in the islands could hardly have overlooked its very conspicuous presence on the leaves of even the youngest plants. It will be interesting to note the arrest of this fungus pest in Fiji, or its possible progress to New Zealand.

If we consider the large population in former times, very much greater than at present, and the relatively small areas of most of these Pacific islands, it is surprising that the agency of man in the distribution of their species should have been rather consistently overlooked. Seemann (**3**) is the one author who insists that owing to this preponderating influence there are practically very few tenable deductions to be drawn from the relative distribution of plants in the different islands. From time immemorial, as he points out, there has been a constant intercourse between the Samoan, Tongan, and Fijian Islanders. As Samoa and Tonga did not grow timber large enough for the great war-canoes which these islanders were renowned in building, this timber was obtained in Fiji, and the canoes were built where it was felled. Sandalwood, much valued for scenting coconut-oil, was also only obtainable in Fiji, and both these most valuable articles of trade had to be obtained by barter in the products of the other islands.

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* Warming, 'History of the Flora of the Færoes: Botany of the Færoes,' ii. Copenhagen, 1903.

With regard to cultivation, to cite Fiji alone, which comprises much the largest area, Seemann (**3.** p. 276) writes that there was no virgin forest to speak of in 1862, and certainly anyone who has travelled through Viti Levu will corroborate the justness of this observation. Every year fresh patches of forest are cut down by the natives for the cultivation of their crops, and these are worked for a year or two and then left to go wild again. These patches may be seen on the highest ridges up to 3500 ft., and if they are pronounced now, must have been more so when the island carried a much larger population depending on home supplies. The tribes were divided, as in all the large Pacific islands, into mountain and coast tribes, invariably at deadly enmity with each other. The coast tribes were then the most numerous, and still line all the islands with an uninterrupted fringe of villages, nestling behind the belt of strand trees. They were in constant communication with the other islands, and disposed of the fertile littoral areas for the cultivation of their crops. Space being limited, that cultivation was necessarily more continuous and not so sporadic as in the mountains, whilst climate and conditions were more favourable to the cultivation and exchange of all the natural products showered so lavishly by nature. The mountain tribes, on the other hand, were restricted to the mountain districts of one island. Many tropical fruits do not flourish at high altitudes, so, cut off from the abundant coast-supplies, river-fish, land-shells and many forms of invertebrates, wild yams and wild fruits would form their chief supplies in a country lacking all quadrupeds, and consequently animal food. In times of scarcity they would be reduced to the wild yams, to obtain which large areas of country are still burnt off. Trees producing any form of edible fruit would be carefully planted as new "towns" were established and fresh land brought under cultivation, and these species would naturally spring up where old cultivation had been.

The South Sea Islander is also a born gardener. All trees and plants are known by name and their utility or beauty appreciated. Their villages are a blaze of colour from the many-hued foliage plants grown round their houses, and magnificent specimen trees shade the levelled grass areas on which their "towns" are built. Favourite species for beauty or use will be planted along their roads or tracks, and the wandering native will preserve seed for future planting of any particular species that may strike his fancy.

Given these conditions, which have prevailed for centuries throughout the Pacific, it will be seen, as Seemann says, how hopeless it is to construct theories of distribution or to expect a pronounced endemic element where natural conditions have never prevailed in recent times. Where man has cleared the dense forest growth, there the wind's agency is well seen in the secondary upgrowth. On a patch over 3000 ft. alt., I found *Spiræanthemum vitiense* and *S. Graeffei* in full flower, species apparently not represented among the surrounding trees, and not noted elsewhere. In a neighbouring patch of older date, *Trichospermum Richii* and *Geissois ternata*, both trees of a lower altitude, were flourishing; here, too, *Polyscias Joskei* was found with *Isachne vitiensis* growing thickly in between, all palpably dry locality types, looking very out of place, possessing wind-borne seeds, which had found a temporary resting-place, to be crowded out later as shade conditions re-established themselves. Even the smallest clearing in the forest, or up the ridges, would result in a luxuriant growth of the alien weeds *Blumea densiflora, Erechtites valerianæfolia, Adenostemma viscosum,* and *Melochia Grayana*, species limited strictly to the illuminated area. Their seeds must be borne here from lower altitudes by the wind, there being no animals to aid in distribution; even the birds are limited to the tree-tops, and rarely seen in the forest-depths.

Of recent introduction, but now fairly established in Viti Levu, *Iresine Herbstii*, in luxuriant possession of large areas in the forest where clearings were made and kept open for the telephone-poles, was perhaps the least expected. *Erechtites valerianæfolia*, in profusion wherever the moister forest-land is opened up, has not previously been recorded. *Salvia coccinea* is gaining ground in the drier open regions, and *Cestrum nocturnum* is well established round the N.W. Coast. The weed *Alternanthera nodiflora* is also new; and *Paspalum filiforme* and *Panicum colonum* are extensively sown, in the hopes of their proving a reliable food for cattle. *Clitoria Ternatea* has probably been brought over by the many Indian coolies employed on the sugar-plantations.

This list is of course only applicable for about Nadarivatu, where the altitude and dense forest act as restraining influences. But in other parts of Fiji the name of the alien weeds is legion, and they are taking possession of areas of country in which injudicious clearing has left virgin soil lying idle.

Melastoma denticulata in the Naisouri district has invaded the country to such an extent that it has been honoured with the name of "Kester's curse," because, though really an indigenous plant, it was supposed to have been introduced by that unfortunate individual. A *Psidium* species is almost as troublesome.

If no official limit is placed on individual idiosyncrasies in the shape of forest destruction, Fiji bids fair to rival New Zealand in heterogeneous flora and sterile wastes, or Norfolk Island *, where the weed upgrowth almost inhibits cultivation, the original forest-growth having all been destroyed.

My best thanks are due to His Excellency Sir Everard im Thurn, K.C.M.G., to Dr. Corney, Chief Medical Officer at Suva, and also to Mr. Adolf Joske, for his unfailing kindness during my stay at Nadarivatu. I am further indebted to Dr. Stapf and Dr. Rendle, Mr. E. G. Baker, and Mr. Spencer Moore for assistance most kindly given; also to M. C. de Candolle, Mr. Henry Groves, and Mr. W. West for working out specific genera, and especially to Miss A. Lorrain Smith and Mr. A. Gepp for the references, systematic arrangement, and geographical distribution, in addition to specific determination, in the Fungi, Mosses, and Liverworts.

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* J. H. Maiden, in Proc. Linn. Soc. N. S. Wales, xxviii. (1904) 768.

In conclusion I must express my obligation to Dr. A. B. Rendle for the many facilities afforded to me at the British Museum, where duplicates of nearly all the species enumerated may be consulted.

LIST OF PLANTS *collected in August, September, and October,* 1907, *from an elevation of* 2700 *ft. at Nadarivatu, in the Island of Viti Levu, Fiji.*

VIOLACEÆ.

AGATEA VIOLARIS, *A. Gray, Bot. U.S. Expl. Exp.* 89, t. 7.

Nadarivatu, 2700*, scandent in mixed forest, general. Fl. Aug.–Sept. 558.

Distrib. Fiji (Viti Levu, Ovalau, Taviuni, Moala).

A twining liane, with coriaceous leaves and cream-coloured flowers with brown markings.

MELICYTUS RAMIFLORUS, *Forst. Char. Gen.* 124.

Nadarivatu, 2700, on road to Navai, in mixed forest. Fl. ♀ Sept. 749.

Distrib. Norfolk and Kermadec Islands, New Zealand and Tonga (Eua).

This plant, of which the type is from Norfolk Island, has not previously been recorded for Fiji.

PITTOSPORACEÆ.

PITTOSPORUM BRACKENRIDGEI, *A. Gray, Bot. U.S. Expl. Exp.* 225, t. 17.

Base of Koro Levu, 500, fringing wood by stream. Fl. Sept. 764.

Distrib. Fiji (Vanua Levu, Ovalau, Nairai, Matuku, Moturiki). Tonga.

PITTOSPORUM NADARIVATENSE, sp. nov.

Arbor; foliis ad apices innovationum confertis, longe petiolatis, coriaceis, superne nitidis, oblongo-lanceolatis, apiculatis, basi acuminatis, integerrimis, costa media prominente; umbellis corymbosis paniculatis, longe pedunculatis, ex axillis foliorum 1–2 ortis; floribus albis, pedicellatis; calycibus minutis inæqualiter 5-dentatis, dentibus brevissimis, rotundatis vel acutis; petalis linearibus obtusis, apice recurvatis; staminibus inclusis; ovario puberulo, stylo brevi, stamina fere æquante; placentis 2, multi-ovulatis.

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* These figures following the locality refer to the elevation in feet at which the plants were found.

Hab. Nadarivatu, 2700, general in forest. Fl. Aug. 581, 577 bis.

A tree, 10 m. high, with glabrous leaves, aromatic when bruised; petioles 2–3 cm. long, leaves 1·3 dm. long and 4–6 cm. broad. Flowers white, sweet-scented, aggregated subumbellately (but sometimes reduced to one flower) at the extreme end of the villous peduncles, which are from 1–3 cm., while the pedicels, also villous, are normally 9 mm. long. The calyx is gamopetalous, shortly persistent, 1·5 mm. long; the petals are 1 cm. long and 2 mm. broad, free and very caducous; the stamens are inserted at the base of the ovary, the filaments being 5 mm. and the anthers 2·5 mm. long. The ovary is hairy, 5 mm., and the style 2 mm. in length.

This species is nearest to *P. Richii*, A. Gray, but differs in the glabrous stem, longer petioles, shining leaves, and smaller calyx.

TERNSTRŒMIACEÆ.

Eurya acuminata, *DC. Mém. Ternstr.* 26.

Vatavula, 500, in mixed forest. Fl. Aug. 532.

Distrib. Fiji (Viti Levu, Ovalau, Kadavu, Ngau, Totoya). New Hebrides, Samoa, Hawaii. N.E. India and Malaya.

*Saurauia rubicunda, *Seem. Fl. Vit.* 14.

Nubamakito, 1000, in open clearings, general. Fl. Aug. 520.

Distrib. Fiji (Viti Levu, Vanua Levu, Ovalau, Ngau).

A most exquisite plant, the lovely fleshy-pink flowers hanging in showers beneath the handsome foliage. The flowers vary in depth of colour and size on different trees, ranging from 1·7–3 cm. across. The Fijian name is "Kau alewa" or the woman's tree. I did not see it about Nadarivatu, which was probably too high an elevation.

STERCULIACEÆ.

Melochia odorata, *Linn. f. Suppl.* 302.

Nubamakito, 1000, open clearings, general. Fl. Aug. 521.

Distrib. Fiji (Vanua Levu, Ovalau, Totoya, Nairai, Matuku). Samoa, Tonga, New Hebrides. New Caledonia, Malaya.

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* Dr. Stapf informs me that this genus is named after Count Saurau, therefore the usual spelling is incorrect.

TILIACEÆ.

TRICHOSPERMUM RICHII, *Seem. Bonplandia*, ix. (1861) 254.

Nadarivatu, 2700–3300, clearings in forest. Fl. Sept. 643.

Distrib. Fiji (Viti Levu). Samoa and Solomon Islands.

In the flowers of this species the calyx is brown and the petals cream-colour. The old capsules are very persistent, the valves remaining hygroscopic, even in a quasi-skeletonized condition. On a specimen at Kew from the Solomon Islands (*Comins*) the flowers are described as "purple, the bark yielding a valuable fibre, which makes the best bags."

ELÆOCARPUS (§ MONOCERA) KAMBI, sp. nov. (Pl. **13**. figs. 11–13.)

Arbor excelsa; foliis alternis, petiolatis, ovatis, acutis vel subobtusis, basi leviter acuminatis, integerrimis, superne glabris, subtus ad nervos sparse pubescentibus mox glabrescentibus; petiolis lamina multo brevioribus, breviter fulvo-tomentosis; racemis axillaribus paucifloris; floribus majusculis albidis; sepalis 5, valvatis, extus pilosis, petalis totidem, sepala excedentibus, laciniatis; ovario dense sericeo, biloculari; stylo subulato, exserto; capsula ignota.

Hab. Nadarivatu, 2700, in mixed forest. Fl. Oct. 808.

A fine forest-tree, 26 m. high, with spreading rounded crown, very general. The small coriaceous leaves are aggregated at the ends of the branches, with tawny tomentose petioles 1·5 cm. in length, the blades being ± 4·6 cm. long and 2–2·5 cm. broad. The flowers hang 3–4 on pendent villous peduncles, shorter than the leaves, ± 1·5 cm. long, the pedicels, also villous, being about the same length; the narrow calyx-lobes are white, 2·1 cm. long, while the petals are ± 1·4 cm. long and 4 mm. broad. The scales which enclose the white stamens are small and pilose; the filaments are hairy, 3 mm. long, and the linear anthers are 6 mm. long, with adpressed hairs, tailed, and dehiscing by an apical slit; the ovary is 3 mm. long and the pilose style is 1·2 cm.

This species is nearest *E. pyriformis*, A. Gray, in the size and shape of leaves and approximate form of inflorescence, but it differs in the entire, glabrous leaves and shorter peduncles and pedicels.

Mr. Adolf Joske informed me that the native name of this tree is "Kabi" (pronounced Kambi). The edible fruit is appreciated by the Fijians.

RUTACEÆ.

ACRONYCHIA PETIOLARIS, *A. Gray, Bot. U.S. Expl. Exp.* 336, t. 33.

Nadarivatu, 2800, open hillside. Fl. Aug. 587.

Distrib. Fiji (Viti Levu, Vanua Levu).

A small tree, with handsome coriaceous shining leaves and small axillary racemes of green flowers. There is no authentic example at Kew or the British Museum, but my specimen agrees with A. Gray's description of the type (in fruit only) and also with two examples of Horne's, at Kew, named *A. petiolaris*.

SIMARUBACEÆ.

AMARORIA SOULAMEOIDES, *A. Gray, Bot. U.S. Expl. Exp.* 356, t. 40.

Off road to Waikubakuba, 2000, fringing wood by stream, N.W. escarpment. ♂ Sept. 692.

Distrib. Fiji (Vanua Levu).

RHAMNACEÆ.

ALPHITONIA EXCELSA, *Reiss. ex Endl. Gen.* 1098.

Nadarivatu, 2700, N.W. escarpment, clearings, general. Fl. & Fr. Aug.–Oct. 575.

Distrib. Fiji (Viti Levu, Vanua Levu, Kadavu, Totoya). Samoa, Tahiti, Tonga, and Rarotonga. Hawaii, New Caledonia, N.E. Australia, New Guinea, Celebes to Borneo.

AMPELIDACEÆ.

LEEA SAMBUCINA, *Willd. Sp. Pl.* i. 1177.

Nadarivatu, 1900, slopes of N.W. escarpment. Fl. Sept. 695.

Distrib. Fiji (Viti Levu, Vanua Levu, Ovalau). N.E. Australia. Tropics of Old World.

SAPINDACEÆ.

GUIOA RHOIFOLIA, *Radlk. in Sitzungsb. K.-Bay. Akad.* ix. (1879) 608.

Nadarivatu, 2700, slopes of N.W. escarpment. Fl. & Fr. Sept. 687.

Distrib. Fiji (Viti Levu, Ovalau, Kadavu).

ANACARDIACEÆ.

DODONÆA VISCOSA, *Jacq. Enum. Pl. Carib.* 19.

Nadarivatu, 2700, edge of escarpment and dry leeside slopes. ♂ ♀ Fr. **551.**

Distrib. Wide in the Pacific and all tropical countries.

RHUS SIMARUBÆFOLIA, *A. Gray, Bot. U.S. Expl. Exp.* 367, t. 44.

Mataculi, by clearing, 2700. Fl. Aug., 877; Oct., 782.

Distrib. Fiji (Vanua Levu). Samoa, Tonga, and Tahiti.

A very handsome tree, 17 m. high, with white trunk and flat crown. The erect axillary racemes of white flowers are very freely produced, and stand well above the pinnate leaves.

LEGUMINOSÆ.

TEPHROSIA PURPUREA, *Pers. Syn.* ii. 329.

Base of Koro Levu, 500, open country, on rocks. Fl. & Fr. Sept. 766.

Distrib. Fiji (Vanua Levu, Totoya, Matuku). In the Pacific and Tropics generally.

CLITORIA TERNATEA, *Linn. Sp. Pl.* 753.

Tavua, 50, near Hot Springs, amongst shrubs fringing stream. Fl. & Fr. Oct. 878.

Distrib. Tonga, Samoa, Hawaii. Philippines, Celebes, Malaya, India.

This plant is a recent introduction for Fiji and has not been previously recorded. I found it undoubtedly established in several localities about Tavua.

DIOCLEA VIOLACEA, *Mart. ex Benth. in Ann. Wien. Mus.* ii. (1838) 132.

Vatavula, 500, scandent on trees. Fl. and young foliage, Aug. 509.

Distrib. Fiji, Tahiti, Hawaii. Tropical S. America.

The only specimens of this species from Fiji consist of three separate leaflets (*Williams*, Brit. Mus.). As it has been collected in Hawaii and Tahiti, Seemann considers it must be indigenous in the Pacific. Native name "Wadra."

SAXIFRAGACEÆ.

GEISSOIS TERNATA, *A. Gray, Bot. U.S. Expl. Exp.* 679, t. 86.

Nadarivatu, 2700, in open clearings, general. Fl. & Fr. Aug.–Sept. 591.

Distrib. Fiji (Viti Levu, Vanua Levu, Ovalau, Kadavu, Lakeba, Ngau, Moturiki).

Seemann gives "Vuga" as the native name for this tree, but the natives about Nadarivatu invariably called it "Vure," never mistaking it for the "Vuga" or *Metrosideros villosa*, which is in flower at the same time.

SPIRÆANTHEMUM VITIENSE, *A. Gray, Bot. U.S. Expl. Exp.* 669, t. 83.

Col i Nadarivatu, 3500, clearing in forest. Fl. Sept. 732.

Distrib. Fiji (Viti Levu, Vanua Levu). New Caledonia.

Spiræanthemum samoense, *A. Gray, Bot. U.S. Expl. Exp.* 667, t. 83?

Nadarivatu, 2700, in mixed forest. ♂ Sept. 673.

Distrib. Fiji, Samoa.

This plant was collected in Fiji by Horne (1007, Herb. Kew.), but no locality is specified.

Spiræanthemum Katakata, *Seem. Fl. Vit.* 111, t. 17.

Nubamakita, 1000, clearings. Fr. Aug. 880.

Distrib. Fiji (Viti Levu, Ovalau, Kadavu). Samoa.

Spiræanthemum Graeffei, *Seem. Fl. Vit.* 111.

Col i Nadarivatu, 3500, clearing in forest. ♂ ♀ Fr. Sept. 731.

Distrib. Fiji (Kadavu).

A handsome shrub with shining coriaceous leaves, the ♂ flowers white. The type (fruit, Herb. Kew.) was collected by Storck on Buke Levu in Kadavu, so that the above makes the second record.

Weinmannia affinis, *A. Gray, Bot. U.S. Expl. Exp.* 674.

Nadarivatu, 2700, edge of escarpment. ♂ 642. ♀ Fr. Sept., 881, 733.

Distrib. Fiji (Ovalau, Viti Levu, Taviuni).

A beautiful shrub, the ♂ plant being covered with erect white racemes, which contrast with the red of the young foliage.

Weinmannia rhodogyne, sp. nov.

Arbuscula, ramulis junioribus glabris; foliis glaberrimis, coriaceis, 3-jugis, foliolis oblongo-lanceolatis, acuminatis, sinuato-serratis, nervis mediis prominentibus, stipulis orbiculatis deciduis instructis; racemis geminis, vel ternis axillaribus atque terminalibus, sub lente minute puberulis, pedicellis florum paulo longioribus, singulis vel binis ternisve congestis; calycibus glabriusculis, 4-meris, laciniis brevibus, glabris; petalis 4, obovatis, lacinias calycinas duplo excedentibus; staminibus petalis paullo longioribus a stylis superatis, cum disci glandulis minutis linearibus alternantibus; gynæceo rubro, capsula ovata, ∞-sperma, stylis quam capsulis brevioribus coronatis.

Hab. Nadarivatu, 2700, clearing, amongst secondary scrub. Fl. Aug. 594.

A small tree, 7 m. in height, with neat crown. The foliage is very dense, the leaves 3-foliate, glabrous, dull, with stipules 4 mm. long and broad and petioles 2 cm. long; the petiole of the central leaflet is ± 6 mm. long, and the leaflet itself is much longer than the lateral ones, which are almost sessile. The racemes are pedunculate, about 8 cm. long and 6 mm. in breadth; the ovary is 3 mm. long and the styles 2 mm. The minute scales are 5 mm. long.

This plant is nearest to *W. Richii*, A. Gray, from which it differs in the glabrous stem, petioles and rhachis, smaller petals and shorter filaments, and the very striking red gynæceum and pilose ovary. The section is probably *Eu-Weinmannia*, but without fruit it is impossible to determine this point.

MYRTACEÆ.

DECASPERMUM FRUTICOSUM, *Forst. Char. Gen.* 74.

Nadarivatu, 2700, edge of escarpment, in clearings. Fl. & Fr. Aug. 552.

Distrib. Fiji (Viti Levu, Vanua Levu, Ovalau, Kadavu, Lakeba, Moturiki). Tahiti, Tonga, Wallis Islands, New Hebrides.

I follow Drake del Castillo in placing this plant under Forster's type for the genus. It is widely distributed in the Pacific Islands and has been collected all over Fiji.

METROSIDEROS VILLOSA, *Sm. in Trans. Linn. Soc.* iii. (1797) 268.

Yasoqo, 800, clearing. Fl. Aug., 545. Fr. Nadarivatu, Sept., 879.

Distrib. Fiji (general). Tahiti, Tonga, Lord Howe's, Kermadec, and Pitcairn Islands, Hawaii, Marquesas.

The flowers of this species are either red or yellow. The two colours may be sometimes seen on one tree. The New Zealand *Metrosideros* sp. occasionally show the same colour variation.

EUGENIA NEUROCALYX, *A. Gray, Bot. U.S. Expl. Exp.* 512, t. 59.

Waikubakuba, base of Koro Levu, on banks of stream. Young fr. Sept. 768.

Distrib. Fiji (Viti Levu, Vanua Levu, Ovalau, Moturiki, Matuku). Samoa, Tahiti, and Tonga.

EUGENIA RIVULARIS, *Seem. Fl. Vit.* 80, *non Cambess.*

Nadrau road, 1000, by stream. Fl. Sept. 748.

Distrib. Fiji (Viti Levu, Ngau).

Flowering in Oct. (*Milne*, Herb. Kew.). Every collector labels this tree as growing near rivers or streams.

EUGENIA EFFUSA, *A. Gray, Bot. U.S. Expl. Exp.* 524.

Nadarivatu, 2700, in mixed forest. Fl. Sept. 662.

Distrib. Fiji (Viti Levu, Vanua Levu Ovalau). Samoa.

MELASTOMACEÆ.

MELASTOMA DENTICULATUM, *Labill. Sert. Austr. Caled.* 65, t. 64.

Nadarivatu, 2700, in dry open spaces. Fl. Aug. 593.

Distrib. Fiji (Viti Levu, Vanua Levu, Ovalau, Totoya, Ngau). New Hebrides, New Caledonia, Tahiti, Samoa, Rarotonga, Solomon Islands.

This shrub only occurred sparingly at Nadarivatu, but in many parts of the island where land has been cleared and neglected it has taken entire possession of the soil, becoming a perfect pest.

MEDINILLA HETEROPHYLLA, *A. Gray, Bot. U.S. Expl. Exp.* 598, t. 75.

Vatavula, Nabucara Hill, 1000, epiphytic in mixed forest, general. Fl. Aug. 539.

Distrib. Fiji (Viti Levu, Ovalau).

MEDINILLA RHODOCHLÆNA, *A. Gray, Bot. U.S. Expl. Exp.* 600.

Nadrau Valley, 2000, epiphytic in forest. Fr. Sept. 745.

Distrib. Fiji (Viti Levu, Ovalau).

MEDINILLA LONGICYMOSA, sp. nov. (Pl. **14**. figs. 21–23.)

Glabra, foliis longe petiolatis, oppositis, ovatis, obtusis, integerrimis, 3-nerviis, costa media subtus prominente; cymis lateralibus 1–3-floris, longe pedunculatis, cymarum bracteis minutis, pulverulentis, bracteis floralibus conspicuis, petiolatis, roseis, lanceolato-acutis, ante anthesin caducis; floribus albis, pedicellatis, 4-meris; calycis tubo cylindraceo, dentibus 4, minimis haud conspicuis, rufo-pulverulentis; petalis late ovatis, acutis, carnosulis; staminibus 8, inter se similibus, antheris elongatis, recurvis, apicibus haud evolutis, connectivo bilobo, anticis unicalcaratis, posticis bicalcaratis; ovario toto calycis tubo adhærente, 4-loculari; stylo columnari, basi incrassato, stigmate punctiforme.

Hab. Nadarivatu, 3500, on wooded ridge. 884.

An interesting epiphyte, of bushy growth, very conspicuous from the foliose floral bracts, which are 1·5 cm. long and 8 mm. wide, of a lovely pink colour, the same shade as in some *Bougainvillea* sp. They fall before the flowers expand. The young inflorescences, minute bracts, and the calyces are pulverulent. My specimens show only buds, which are sufficiently advanced to prove that the plant is a true *Medinilla*, and as the habit differs so much from anything yet known in the genus, I have thought it advisable to figure it. The specimen 547, of exactly the same habit, has much larger bracts, and longer, flexuous pendent peduncles. It is probably a different species.

SAMYDACEÆ.

CASEARIA RICHII, *A. Gray, Bot. U.S. Expl. Exp.* 82, t. 5.

Nadarivatu, 2700, clearings. Fl. & Fr. Aug. 588.

Distrib. Fiji (Ovalau).

This species has not been collected since it was first found in Ovalau by the officers connected with the U.S. Expl. Exp. under Capt. Wilkes, 1838–42. In my specimens the leaves are not so markedly distichous, and are also more acuminate with longer petioles, than is the case in the branch figured in the above plate. The flowers are also pedicellate, not sessile, but otherwise agree with the excellent figures given. The fruit is green, with red seeds, 1·5 cm. in length and 8 mm. broad. It was quite general about Nadarivatu, especially on the Ba road.

PASSIFLORACEÆ.

PASSIFLORA VITIENSIS, *Mast. in Trans. Linn. Soc.* xxvii. (1871) 634.

Vatavula, Nabacara Hill, 1000, festooning over trees in mixed forest. Fl. Aug. 512.

Distrib. Fiji (Viti Levu). Samoa.

A very delicate and graceful species with flowers of a terra-cotta colour; in flower at Nadarivatu in October. The Samoan specimen at Kew is described as having white flowers.

CUCURBITACEÆ.

MELOTHRIA GRAYANA, *Cogn. in DC. Mon. Phan.* iii. 591.

Col i Nadarivatu, 3200, clearing by path in forest. ♀. Sept. 595.

Distrib. Fiji (Viti Levu, Ovalau). Samoa, Tonga, and Tahiti.

UMBELLIFERÆ.

HYDROCOTYLE ASIATICA, *Linn. Sp. Pl.* 234.

Nadarivatu, 2700, cultivated land. Fl. Oct. 810.

Distrib. Tropics of both hemispheres.

ARALIACEÆ.

SCHEFFLERA VITIENSIS, *Seem. Journ. Bot.* iii. (1865) 176.

Nadarivatu, 2700, in mixed forest, common. Fl. Aug. 580.

Distrib. Fiji (Viti Levu, Ovalau).

POLYSCIAS JOSKEI, sp. nov.

Arbuscula, glabra; foliis imparipinnatis multijugis, rhachi nodosa; foliolis breviter petiolulatis, ovatis vel elliptico-oblongis, acutis, integerrimis vel sinuato-undulatis, basi cordatis; racemis masculis compositis paniculatis, brunneis, rhachi nigrescente, bracteis minutis; floribus masculis solitariis, pedicellis infra medium articulatis; pyrenis obovatis, nigrescentibus.

Hab. Nadarivatu, 2700, on edge of forest. Fl. ♂ Sept., 893. Fr. Sept., 750.

A small tree, 3 m. high, with the leaves aggregated towards the ends of the branches, below the terminal inflorescence. The leaves vary from 2·5 to 5 dm. in length, those on the fruiting specimen being the smallest, and only 3–5-jugate. The leaflets vary in shape from obovate, 7 cm. long in the ♀ to 1·5 dm. long in the ♂ plant, both being ±3·5 cm. in breadth. The inflorescence is a compound raceme, ±1·5 dm. long and 2·3 dm. across; the 4-partite ♂ flowers are scattered on the rhachis of the 3rd order, the pedicels, jointed below the middle, being about 2 mm. long. The calyx of the ♂ flower is 1 mm. long, with triangular lobes; the petals are valvate, 3 mm. long; the anthers 2·5 mm. and the filaments 1 mm. in length. The fruiting panicle is 8 cm. long and 1·3 dm. in breadth; the fruit is compressed, splitting into 2 pyrenes; the dense fruiting panicles are very handsome, crowning the terminal rosette of leaves. This species is allied to *P. multijugum*, Harvey, from which it differs in the brown compound raceme, 4-partite ♂ flowers and the compressed fruit.

I have named this plant after Mr. Adolf Joske, the Resident Commissioner of Cholo North, as it is very general about Nadarivatu, where his long residence and sympathetic kindness has endeared him to the natives under his rule. It is also to his initiative and energy that the one bridle-road across Viti Levu from Suva and also the road from Nadarivatu to Ba are due, the responsibility for surveying, cutting, and making falling entirely on his shoulders in both cases.

POLYSCIAS CORTICATA, sp. nov. (Pl. **13**. figs. 14–17.)

Arbuscula; foliis multijugis, imparipinnatis, foliolis petiolulatis oblongo-ovatis, integerrimis, acutis; paniculis terminalibus, pedunculis ultimis racemose dispositis, rhachi lignosa, longitrorsum necnon transversim striata, lenticellis sat crebro indute; floribus 5-meris, calycibus obscure dentatis, petalis valvatis incrassatis; staminibus 5; stylis recurvis patentibus, basi paulo coalitis; ovario biloculari, in quoque loculo uni-ovulato.

Hab. Nadarivatu, 2700, edge of forest. Fl. and immature fruit, Oct. 769.

A small tree with slender stem and round bunchy top, 3 m. high. The large (in specimen 8-jugate) leaves are 6 dm. or more in length, aggregated at the apices of the branches. The leaflets are 1·4 dm. in length and 5 cm. broad, with petiolules 1 cm. long. The terminal, compound, racemose inflorescence is very spreading, about 2 dm. long and 4·5 dm. across; the angular woody rhachis, ash-grey in colour, is evidently persistent, the peduncles, 2–3 mm. long, being surrounded at the base by 3 or 4 scarious bracts, bearing buds in their axils; the bracts of the peduncles are lanceolate, 7 mm. long, those bearing heads being very minute; the flowers are umbellate, 5 or 6 to the whorl, the pedicels being 2–3 mm. long, with small scarious bracts at their base; the calyx is 5-dentate, 2 mm. in length; the petals are 3 mm. long and 1·5 mm. broad, and the almost sessile anthers are 2 mm. long; the ovary is bilocular, and the styles erect in flower.

This species is nearest to *P. Murrayi*, Harms, from which it differs in the larger and entire leaflets, the woody spreading inflorescence, ash-grey in colour, and the bracteate peduncles.

PLERANDRA (§ EU-PLERANDRA) VICTORIÆ, sp. nov.

Arbuscula inermis, glabra; foliis digitatis, stipulatis, dilatatis, foliolis 7, oblongis, obovatis, obtusis vel acutis, basibus in petiolum attenuatis, coriaceis, integerrimis; umbellis multi-radiatis, umbellulis 12–16-floris; calycibus post anthesin repando-undulatis; petalis 5, valvatis, ovato-triangularibus, liberis, mox deciduis; staminibus 35, bi-seriatis; ovario 7-loculari; stylis 7, brevibus, distinctis, stigmatibus simplicibus.

Hab. Summit-ridge of Mt. Victoria, 4000, in moss forest. Fl. & young fr., Sept. 784.

A small tree, with dense crown, of which it was impossible to determine the height, as the trunk was embedded in the prostrate, decaying, moss-clothed logs, which characterize this formation. In the specimen the petiole is 2 dm. and the petiolules 2·5–3·2 cm. long; the leaflets are 1–1·5 dm. in length. The length of the peduncle is 9·5 cm., while the small umbel is ±8 cm. long and 1·2 dm. across; the flowers are most striking, the calyx and outer surface of the petals are black, whereas the thickened inner portion of the latter is gleaming white. The calyx-tube is 3 mm. long and 4 mm. broad. The stamens, in all the buds dissected, numbered 35, in two series, and in flower do not equal the petals, the anthers being 3 mm., while the filaments are 2·5 mm. in length. The fruiting peduncle does not elongate very much, being 9 cm. in length. This plant is nearest to *P. Nesopanax*, Harms, from which it differs in the much smaller leaves and umbels, the notable black and white colouring of the flowers, and the definite number of stamens in two series.

RUBIACEÆ.

XANTHOPHYTUM CALYCINUM, *Benth. & Hook. f. Gen.* ii. 53.

Nadarivatu, ridge of Matani Siga, 3200, in mixed forest. Fr. Sept. 704.
Distrib. Fiji (Viti Levu, Ovalau).
I am indebted to Dr. Stapf for the determination of this plant.

HEDYOTIS CRATÆOGONUM, *Spreng. Pug.* ii. 35.

Slopes of N.W. escarpment, 1500, common weed of cultivation. Fl. Oct. 874.

Distrib. Fiji (Vanua Levu, Ovalau, Nairai, Ngau, Totoya). Solomon Islands, Malaya, Asia.

OPHIORRHIZA LAXA, *A. Gray, in Proc. Am. Acad.* iv. (1858–59) 312.

Nadarivatu, 2700, undergrowth in forest, general. Fl. Aug. 606.

Distrib. Fiji (Viti Levu, Ovalau, Ngau). Tahiti.

Herbaceous plant, 1–1·50 m. in height, with flaccid leaves and pinkish-white flowers. It runs into *O. leptantha*, A. Gray.

OPHIORRHIZA PEPLOIDES, *A. Gray, in Proc. Am. Acad.* iv. (1858–59) 311.

Nadarivatu, 2700, undergrowth in forest, also along road-cuttings, general. Fl. Aug. 607.

Distrib. Fiji (Ovalau, Matuku, Taviuni).

Herbaceous plant, 4 dm. in height, with very small dark green leaves, lighter on the under surface, and white flowers.

MUSSÆANDA FRONDOSA, *Linn. Sp. Pl.* 177.

Nadarivatu, open slopes of N.W. escarpment, 2000. Fl. Sept. 690.

Distrib. Fiji, Tonga, Wallis Island, Tahiti, Malaya, E. India.

GARDENIA VITIENSIS, *Seem. Fl. Vit.* 122, t. 26.

Nadarivatu, 2700, in mixed forest. Fl. Sept. 753.

Distrib. Fiji (Vanua Levu).

The young form of this plant shows the tropical characteristic of sending up one single shoot with enormous leaves, three or four times the size of those on the adult plant. This species is general in the forest, and easily recognized in this stage by the curious form of bud-protection, of a shining yellow resinous substance.

MORINDA FORSTERI, *Seem. Fl. Vit.* 129.

Vatavula, 700, twining liane in mixed forest. Fl. Aug. 538. Fl. & Fr. Aug. Nadarivatu, 2700. 561.

Distrib Fiji (Viti Levu), Samoa, Tonga, Tahiti, Marquesas, Loyalty Islands, and Isle of Pines.

Flowers mauve-cream, fleshy, and sweet-scented ; very general.

PSYCHOTRIA STORCKII, *Seem. Fl. Vit.* 135.

Nadarivatu, 2700, general in mixed forest. Fl. & Fr. Sept. 702, 742 bis.

Distrib. Fiji (Viti Levu, Ovalau, Taviuni).

Shrub to small tree 13 m. high, with large glabrous leaves, aggregated towards the ends of the branches. The very caducous corollas are white, and the fruit is yellow.

PSYCHOTRIA SULPHUREA, *Seem. Fl. Vit.* 134.

Nadarivatu, 2700, scandent in forest, general. Fl. Sept. 660, 542, 813 bis.
Distrib. Fiji (Ovalau).

Described by Seemann from Storck's specimen as "a decumbent shrub," this charming species is very common in the forest as a stem-twining liane. The leaves are dark green and herbaceous, the small flowers are white, borne profusely in large cymose panicles. Though very general at Nadarivatu and the surrounding country, it has only been collected by Horne since Storck's original discovery of the plant.

PSYCHOTRIA PLATYCOCCA, *A. Gray, in Proc. Am. Acad.* iv. (1860) 47.

Nadarivatu, 2700, mixed forest. Fl. Aug. 596.

Distrib. Fiji (Viti Levu).

A small tree with glabrous, herbaceous, light green leaves and small white flowers in axillary racemes. Mr. Spencer Moore, who kindly determined the *Psychotria* sp., adds:—"Seems to me nearest *P. platycocca,* A. Gray, but the leaves are smaller and less coriaceous, though subrotundate at the base like those of *P. platycocca*, of which there is no authentic specimen of the flowers in this country."

PSYCHOTRIA GIBBSIÆ, *S. Moore*, sp. nov.

Frutex vel arbuscula, ramulis ultimis crebre foliosis, cortice plus minus albido circumdatis, nodis ferrugineo-pubescentibus, novellis glabris; foliis petiolatis, oblongo-lanceolatis vel anguste obovato-oblongis, sursum cuspidato-attenuatis, apice acutiusculis, basi obtusis, tenuiter coriaceis glabris, costis secundariis utrinque 7–10 ad angulum fere rectum costæ centrali insertis levissime arcuatis; stipulis caducis, basi latis ubi conjunctis bipartitis, segmentis lineari-lanceolatis acuminatis; cymis terminalibus foliis brevioribus sublaxe paucifloris griseo-puberulis, pedicellis sæpius calyce brevioribus rarissime calycem subæquantibus; floribus pentameris; ovario subhemisphærico, puberulo; calycis diutule persistentis puberuli limbo ovarium longe excedente campanulato, lobis deltoideo-ovatis obtusiusculis quam tubus plane brevioribus; corollæ griseo-pubescentes, tubo calycem excedente a basi sensim leviterque ampliato, lobis oblongis obtusis tubo brevioribus; staminibus paullo infra fauces affixis inclusis; stylo exserto minute puberulo.

Hab. Nadarivatu, 2700, edge of N.W. escarpment, Sept. 664, 734.

Folia solemniter 4–8 cm. longa, 1·5–3·3 cm. lata, viva nitida, in sicco olivaceo-fusca; petioli 3–5 mm. long. Stipularum basi persistentum vagina 3 mm., segmenta 5 mm. longa, margine ciliolata. Cymæ 2 × 1·5–2 cm.

Pedunculus ±5 mm. longus; pedicelli sæpius 3–4 mm. longi. Flores albi. Ovarium 2·5 mm. longum. Calyx 8 mm. longus; lobi 2·5 mm. Corollæ tubus 12 mm. longus, faucibus 2·5 mm. latis; lobi 3·5 mm. longi. Stamina ad 3 mm. infra os tubo affixa; filamenta fere 1 mm. longa; antheræ lineares, 2·75 mm. longæ. Discus crassus, 1 mm. altus. Stylus 1·3 cm. longus, medio incrassatus. Bacca subsphæroidea, disco accrescente maxime prominente necnon calycis reliquiis coronata, verisimiliter adhuc aliquanto cruda, 4 mm. diam.

Differs from *P. calycosa*, A. Gray, in the hairy cymes, larger ovaries, long calyces, and the pubescent corollas.

Psychotria griseifolia, *S. Moore*, sp. nov.

Frutex vel arbuscula, ramis satis validis sursum foliosis, cortice cinereo obductis, novellis minute griseo-pubescentibus; foliis petiolatis, oblongo-obovatis, obtusis, leviter angustatis, breviter cordatis, papyraceis, in sicco griseo-viridibus, subtus pallidioribus subtus ad costas minute pubescentibus, costis secundariis utrinque 13–15 tribus basalibus approximatis, patulis, marginem versus solummodo arcuatis; stipulis lineari-lanceolatis, sursum gradatim attenuatis, apice obtusiusculis, dense etsi minute griseo-pubescentibus; cymis subterminalibus quam folia brevioribus, fere a basi ramosis, ramis patentibus, filiformibus, minute griseo-pubescentibus, unoquoque cymulam laxiusculam paucifloram suffulciente; floribus sessilibus vel pedicellatis. bracteis comparate amplis, flores amplectantibus, caducis, ovatis, scariosis. puberulis; ovario turbinato, puberulo, quam calyx truncatus vel undulatus et glaber paullulum longiore; corollæ paullo ultra medium divisæ glabræ tubo breviter ex calyce eminente, lobis 6, oblongis, acutis, apice incrassatis inflexisque; staminibus faucibus insertis, filamentis antheras oblongas breviter exsertas paullulum excedentibus; styli crassi inclusi ramis lamellosis.

Hab. Ridge of Matani Siga, 3100. Sept. 706.

Foliorum limbus 7–13·5 cm. longus, 3·3–5·5 cm. latus; petioli 1–2 cm longi, minute griseo-pubescentes. Stipulæ circa 1 cm. longæ. Cymarum rami ±3 cm. longi. Pedicelli summum circa 3 mm. longi. Flores albi. Ovarium 1·25 mm., calyx 1 mm. longus. Corollæ tubus 1·5 mm., lobi ægre 2 mm., filamenta 0·75 mm., antheræ 0·6 mm. longæ. Discus maxime incrassatus. Stylus 1 mm., rami vix 0·5 mm. longus.

The cordate leaves and lax inflorescence serve to distinguish this from other Polynesian species.

Hydnophytum grandiflorum, *Becc. Malesia*, ii. 171, t. 44.

Nadarivatu, 3000, epiphyte in forest. Fl. Sept. 729.

Beccari in his description of this plant suggests a possible dimorphism of the style, as in two buds dissected by him it was long in one case and short in the other. In my specimens there are nine open flowers, but in each

one the style is exserted about the same length. There is, however, some variation in the length of the corolla-tube, specimens gathered on Mt. Victoria showing a shorter tube than those from Col i Nadarivatu. The latter plant had branches about a metre long, and the white, slightly scented flowers opened in the evening. The tubes are about 3–3·5 cm. in length and 1 mm. broad, the lobes of the corolla 6 mm. long and 4 mm. broad, and the styles exserted 6 mm. The tuber was large, about 2 dm. across, and tapered from the broad base to 2·5 dm. in height.

COPROSMA IMTHURNIANA, sp. nov.

Frutex, ramulis junioribus pubescentibus; stipulis acuminatis pilosis, foliis petiolatis, anguste lanceolatis, longe acuminatis, herbaceis, sparsim hirsutis, basi in petiolum brevem attenuatis, mox nervis pubescentibus exemptis fere nimis glabris, in sicco griseo-cinereis, nervis lateralibus 6–7; florum fascialis axillaribus, pedunculatis, albo-pubescentibus, bracteis pluribus parvis onustis; fl. ♂ calyce ovoideo, tubo sub-elongato 4-lobo, corolla infundibulari 4-lobo; fl. ♀ corolla infundibulari, usque ad medium 4-loba, lobis revolutis; staminibus 4, fundo corollæ tubi affixis, filamentis corolla duplo longioribus; ovario 2-loculari; drupa ovoidea, 2-pyrena.

Hab. Nadarivatu, 2700, clearings. ♂ Aug. 554. ♀ Aug. 543.

A shrub of straggling habit, with grey stems which, with the young shoots and leaves, are very pilose; the latter are greyish on the underside, minutely serrate, ±10 cm. long and 3 cm. broad. In the green flowers the petals of the ♂ are 2 mm. long and 1 mm. broad; the filaments are 3 mm., and the anthers, sagittate at the base, 2 mm. long. The peduncle of the ♀ inflorescence is ±4 mm. long, and the corolla-tube is less than the recurved petals, which are 2 mm. long and narrower than those of the ♂ flower. The styles are white, 8 mm. in length, and very pilose; the immature drupe ovoid. This species is nearest to *C. acutifolia*, Hook. f., from the Kermadec Islands, but differs in the pilose habit, the narrow lanceolate and very long-acuminate leaves, the aggregated inflorescences, and the smaller flowers.

This same plant was collected by Horne (129, Herb. Kew.) in the Lavoni Valley, Ovalau, and on Rabi Island.

COMPOSITÆ.

VERNONIA CINEREA, *Less. in Linnæa*, iv. (1829) 291.

Nadarivatu, 2700, common everywhere in dry places. Fl. Aug., Oct. 873.
Distrib. A tropical weed of both hemispheres.

ADENOSTEMMA VISCOSUM, *Forst. Char. Gen.* 90.

Nadarivatu, 2700, waste and cultivated places. Fl. Sept. 644.
Distrib. Tropical weed of Old World.

Blumea densiflora, *DC. Prod.* v. 446.

Nadarivatu, 2700, clearings in forest. Fl. Sept. 637.

Distrib. Fiji (Viti Levu, Ovalau, Moala). Samoa, New Hebrides, New Caledonia, Malaya, India.

Erechtites valerianæfolia, *DC. Prod.* vi. 295.

Nadarivatu, 2700, everywhere in clearings. Fl. Oct. 811.

Distrib. American origin, now distributed through the Tropics.

Popularly called "Ceylon Thistle": is considered good food for cattle. Curiously enough this plant is apparently not recorded for the Pacific. There is one specimen from Fiji (Herb. Kew.).

GOODENIACEÆ.

Scævola floribunda, *A. Gray, in Proc. Am. Acad.* v. 152 (1861).

Nadarivatu, 2700, general in open country. Fl. Aug. 875.

Distrib. Fiji (Viti Levu), Tonga.

VACCINIACEÆ.

Agapetes vitiensis, *Drake, Illus. Fl. Ins. Mar. Pacif.* 243.

Summit of Mt. Victoria, 4000, moss forest. Fl. and young fr., Oct. 783.

Distrib. Fiji (Viti Levu, Kadavu).

A compact shrub, 3 m. in height; the corolla is cream-coloured, suffused with red, the calyx and immature fruit red. It has been recorded from the summit of Buke Levu in Kadavu and Voma Peak in Viti Levu, and also grows on the summit of Kuvadra, the Sacred Mountain of the Fijians, who consequently call the plant the Sacred "Vuga.'

MYRSINACEÆ.

Maesa corylifolia, *A. Gray, in Proc. Am. Acad.* v. (1861–62) 330.

Nadarivatu, 2700, scandent in forest, or as shrub in clearings, common. Fl. & Fr. Aug., Sept. 556, 557.

Distrib. Fiji (Viti Levu, Ovalau, Ngau).

Discocalyx fusca, sp. nov. (Pl. **13.** figs. 5–10.)

Tota planta glaberrima; foliis alternis, ad apicem ramulorum congestis, petiolatis, oblongis, obtusis, basi in petiolum cuneatim angustatis, integerrimis, coriaceis, nervis lateralibus tenuibus numerosis, utrinque 17–20; paniculis terminalibus vel subterminalibus, fere a basi ramosis, ramulis patentibus; floribus parvis, pedicellatis; calycis segmentis rotundatis, ciliatis, glanduloso-punctatis; corollæ tubo brevissimo, limbo 5-partito, segmentis oblongis, obtusis, punctatis, dextrorsum obtegentibus; staminibus sessilibus inter se liberis; antheris ovatis, acuminatis, basi hastatis; ovario conico, glabro in stylum subulatum attenuato, ovulis 2–3.

Hab. Nadarivatu, 3500, on wooded ridge. Fl. Sept. 723.

A small tree, 4 m. in height with leaves ± 6·5 cm. long and 2·7 cm. across, on petioles 7 mm. long. The flowers, chocolate-brown in colour, are small, the calyx-lobes being 1 mm. long, the petals 3·5 mm. long and 2 mm. across; the almost sessile stamens, inserted at the base of the corolla-tube, are 3 mm. long and 1·5 mm. in breadth, and they inarch over the ovary, their sides just touching all round it. The ovary is 2 mm. in length and the style 0·5 mm., the two or three ovules being inserted in the tissue of the placenta.

This species is very near *D. Listeri*, Stapf & Metz, from the Tonga Islands (Eua), but differs chiefly in the leaves, which are smaller and much closer veined, the smaller inflorescences and flowers, and the much longer style.

STYRACEÆ.

SYMPLOCOS SPICATA, *Roxb. Hort. Beng.* 40.

Between Yasoqo and Navai, 3000, forest. Fl. Aug. 541. Nadarivatu, Sept. 668.

Distrib. Fiji (Vanua Levu, Ovalau, Kadavu, Ngau). Oceania, tropical Australia and Asia.

OLEACEÆ.

JASMINUM SIMPLICIFOLIUM, *Forst. f. Prod.* 3.

Nadarivatu, 2700, scandent in forest. Fl. Sept. 657.

Distrib. Tonga Islands (Tongatabu).

This is the true *J. simplicifolium* of Forster (*fide* type Brit. Mus.!) with long subulate calyx-lobes as figured in Bot. Mag. t. 980.

APOCYNACEÆ.

ALYXIA SCANDENS, *Roem. & Schult. Syst.* iv. 440.

Nadarivatu, 2700, scandent in forest. Fl. Aug. 598.

Distrib. Fiji (Ovalau), Samoa, Tahiti, Pomatou Islands.

ALYXIA STELLATA, *Roem. & Schult. Syst.* iv. 439.

Nadarivatu, 2700, scandent in forest. Fl. Sept. 669.

Distrib. Fiji (Totoya, Nairai), Samoa, Tahiti Tonga, New Caledonia, Norfolk and Amsterdam Islands. Tropical Asia.

Cerbera Odollam, *Gaert. Fruct.* ii. 193.

Nadarivatu, 2700, fringe of forest. Fl. Aug. 560.

Distrib. Fiji (Viti Levu). Oceania, Malaya, India.

Alstonia plumosa, *Labill. Sert. Austr. Caled.* 28, t. 32.

Nadarivatu, 2700, edge of escarpment. Fl. & Fr. Aug.–Sept. Flowers orange-yellow, 563; cream, 605.

Distrib. Fiji (Viti Levu, Vanua Levu), Samoa.

A handsome tree, with shining, coriaceous leaves, flowers orange-yellow to cream. The long mericarps are very characteristic and so is the abundant latex.

ASCLEPIADACEÆ.

Asclepias curassavica, *Linn. Sp. Pl.* 215.

Nadarivatu, 2700, common weed on waste ground and in gardens. Fl. Aug. 592.

Distrib. Of South American origin, is now spreading in all tropical countries.

Hoya australis, *R. Br. ex Traill in Trans. Hort. Soc.* vii. (1830) 28.

Base of Koro Levu, 500, open country, twining up trees fringing streams. Fl. Sept. 765.

Distrib. Fiji (Viti Levu, Ovalau), Samoa, N.E. Australia.

LOGANIACEÆ.

Geniostoma rupestre, *Forst. Char. Gen.* 24, t. 12.

Nadarivatu, 2700, edge of escarpment, clearings, common. Fl. & Fr. Aug., Sept., 555. Fl. Sept., 3000, 724.

Distrib. Fiji (Viti Levu), Tahiti, New Caledonia and New Hebrides, Norfolk and Wallis Islands.

Shrub, 1–2 m. high, with coriaceous smooth leaves and small white flowers, which emit a perfectly fœtid odour; they are fertilized by flies. No. 724 has larger flowers, and is scentless.

Couthovia Seemannii, *A. Gray, in Proc. Am. Acad.* v. (1861) 320.

Nadrau Valley, 1500, by stream. Fl. Sept. 746.

Distrib. Fiji (Viti Levu, Ovalau).

In the above specimen the leaves are much smaller and more coriaceous than the type. Dr. Stapf kindly allowed me to dissect a flower from the latter, which on comparison agreed in every detail with mine. There is a specimen of Horne's (924 Herb. Kew. indet.) which forms an interesting intermediate.

CONVOLVULACEÆ.

CUSCUTA DENSIFLORA, *Hook. f. Fl. N. Zeal.* i. 186.

Nadarivatu, 2700, on *Stachytarpheta dichotoma.* Fl. & Fr. Oct. 814.
Distrib. Fiji (Viti Levu), New Zealand.

SOLANACEÆ.

SOLANUM REPANDUM, *Forst. f. Prod.* 18.

Nadarivatu, 2700, common everywhere on cultivated land. Fl. Oct. 840.
Distrib. Fiji (Viti Levu), Samoa, Tahiti, Hawaii, Marquesas, Solomon Islands, Rarotonga, and Pitcairn Island.

SOLANUM TETRANDRUM, *R. Br. Prod.* 445.

Nadarivatu, 2700, in forest. Fl. & Fr. Sept. 615.
Distrib. Fiji (Viti Levu, Vanua Levu, Ovalau, Ngau, Nairai, Totoya, Kadavu). E. tropical Australia.

SOLANUM VITIENSE, *Seem. Fl. Vit.* 176, t. 36.

Nadarivatu, 2700, forest. Fl. & Fr. Aug. 568.
Distrib. Fiji (Viti Levu, Ovalau), Samoa, Solomon Islands.

PHYSALIS PERUVIANA, *Linn. Sp. Pl.* ed. 2, 1670.

Nadarivatu, 2700, road to Navai. Fl. Sept. 707.
Distrib. Tahiti, Hawaii, Marquesas. New Zealand, N.E. tropical Australia. Tropical Asia, America, and Africa.

CESTRUM NOCTURNUM, *Linn. Sp. Pl.* 191.

Nadarivatu, 2000, open slopes of N.W. escarpment. Fl. Sept. 686.
Distrib. Central America, West Indies, Madeira, Siam, Surinam.

Evidently a recent introduction in Fiji. I was told it was also common in other places on the Leeward side of Viti Levu, but cannot find it recorded for Polynesia.

GESNERACEÆ.

CYRTANDRA VITIENSIS, *Seem. Fl. Vit.* 182.

Summit of Mt. Victoria, 4000, in moss forest. Fl. & Fr. Sept. 797.
Distrib. Fiji (Vitu Levu).

A shrub, 6 m. in height, with large dark green leaves lighter on the underside, the largest 5–6 dm. in length. Flowers green, the very caducous corolla 2–3 cm. long, barely exceeding the large membranous, persistent calyx, which is 2 cm. long and 9 mm. broad. The fruit is creamy green in colour, glabrous and shining. The flowers are glandular and mucilaginous, and like the fruit very deliquescent, which makes the plant most difficult to dry. The original description was founded on incomplete specimens.

CYRTANDRA INVOLUCRATA, *Seem. Fl. Vit.* 183.

Nadarivatu, 2700, slopes of N.W. escarpment. Fl. & Fr. Aug.–Sept. 640, 696 bis.

Distrib. Fiji (Viti Levu).

This shrub is very common in fringing woods by streams where the forest growth gradually thins out towards the open Leeward country. The calyx is membranous, yellow-green to white, the corolla is cream-coloured, and the fruit white and glabrous.

CYRTANDRA GLABRATA, *Sol. [Dryander], MS. in Herb. Mus. Brit.*[*] *ex C. B. Clarke, in DC. Monogr. Phan.* v. 277.

Nadarivatu, 2700, on edge of forest. Fl. & Fr. Aug. 572.

Distrib. Tahiti.

This species was first collected in Tahiti by Banks and Solander, and since by Vesco and Lépine, but has not previously been recorded for Fiji.

CYRTANDRA PRITCHARDII, *Seem. Fl. Vit.* 181, t. 39.

Vatavula, 500, in forest, general. Fl. & Fr. Aug. 537.

Distrib. Fiji (Ovalau).

ACANTHACEÆ.

ERANTHEMUM LAXIFLORUM, *A. Gray, in Proc. Am. Acad.* v. (1861) 349.

Nadarivatu, 2000, on road to Nudrau, scandent in forest. Fl. Sept. 744.

Distrib. Fiji (Vanua Levu, Ovalau, Moturiki), New Hebrides.

A lovely species, from its abundance of fine, mauve-grey flowers.

GRAPTOPHYLLUM SIPHONOSTENA, *F. Muell. Fragm.* vi. 87, *in obs.* [†].

Vatavula, Nabacara Hill, 800, in mixed forest. Fl. Aug. 535. Nadarivatu, 3000. Fl. Sept. 597.

Distrib. Fiji (Ovalau), Tonga.

Collected in 1852 in Ovalau (*Milne*, Herb. Kew.), this plant is not recorded by Seemann for Fiji, nor is the genus or species given for Polynesia by Drake del Castillo.

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[*] *Vide* Britten, in Journ. Bot. xlv. (1907) 314.

[†] See Hemsley, "Flora of the Tonga or Friendly Islands," Journ. Linn. Soc., Bot. xxx (1894) 214, for full description of this plant by Dr. Stapf.

VERBENACEÆ.

STACHYTARPHETA DICHOTOMA, *Vahl, Enum.* i. 207.

Nadarivatu, 2700, on waste and cultivated land. Fl. Aug.–Oct. 812.

Distrib. Tropical and sub-tropical countries.

Of tropical American origin this weed has spread through the Pacific Islands. It has not previously been recorded for Fiji and Drake del Castillo only gives it for Hawaii, but it is abundant in Samoa and the Tonga Islands. popularly called "Rats' tails."

PREMNA TAITENSIS, *Schau. in DC. Prod.* xi. 638.

Mataculi, 2800, fringe of forest. Fl. Oct. 834.

Distrib. Fiji (Viti Levu, Ovalau, Nairai, Moala), Tahiti, Samoa, Tonga, Marquesas and Admiralty Islands, New Hebrides.

CLERODENDRON AMICORUM, *Seem. Bonplandia,* x. (1862) 249.

Nadarivatu, 2700, liane, running up forest trees, general. Fl. & Fr. Aug.–Oct. 576, 559, 872.

Distrib. Fiji (Viti Levu), Samoa, Tonga.

This liane is the most ornamental plant in Fiji. The flowers are of a waxy consistency, resembling *Stephanotis* in texture, and gleaming white in colour. Owing to the extreme reduction of the peduncles, the flowers form thick clusters in the axils of the leaves, but the terminal inflorescence is cymose paniculate. The flowers are polymorphic, style and stamens varying in length, those with exserted stamens having a broader and shorter tube with larger lobes to the perianth (576), while others with the stamens flush with the mouth of the corolla, have a longer and narrower tube with smaller corolla-lobes (559). Each form is restricted to individual plants.

On consulting the Herb. Kew. I found that Mr. Burkill had noted the same fact in the Herbarium specimens, and had appended two rough sketches of extreme corolla forms to one of the specimen sheets. *Faradaya vitiensis,* Seem., founded on a specimen collected by Storck in Vitu Levu, is probably also *C. amicorum,* showing axillary flower clusters, as noted above, the corollas of the type matching those of my no. 872 exactly in shape and size.

LABIATÆ.

PLECTRANTHUS FORSTERI, *Benth. Lab. Gen. et Sp.* 38.

Nadarivatu, 2500–3000, dry open ground, on exposed volcanic agglomerate. Fl. & Fr. Sept. 650.

Distrib. Fiji (Viti Levu, Vanua Levu, Taviuni), New Hebrides.

Salvia coccinea, *Juss. ex Murr. in Comm. Gotting.* i. (1778) 86, t. i.

Nadrau valley, 1000. Fl. & Fr. Sept. 761.

Distrib. North America, West Indies, Africa, Madeira, India.

The specimen was from Mr. Adolf Joske's garden at Nadarivatu, the seeds having been collected by him in an undoubtedly wild situation, under the impression that it was a native. It is a new introduction for Fiji, but there is a specimen at Kew from Tonga (Vavau), and Maiden records it as one of the principal weeds on Norfolk Island *.

NYCTAGINACEÆ.

Pisonia umbellifera, *Seem. Fl. Vit.* 195.

Between Yasoqo and Navai, 3000, in mixed forest. Fl. ♀ Aug. 546.

Distrib. Fiji (Viti Levu, Kadavu), Tonga, Rarotonga, Tahiti, and Hawaii. East trop. Australia to Ceylon.

AMARANTACEÆ.

Alternanthera nodiflora, *R. Br. Prod.* 417.

Nadarivatu, 2700, on road to Waikubakuba. Fl. Sept. 688.

Distrib. Tropical weed of Old World. Not previously recorded from Fiji.

Iresine Herbstii, *Hook. in Gard. Chron.* 654 (1864).

Between Yasoqo and Navai, 3000, clearings in forest, on the Suva road. ♀. Aug. 865.

Distrib. Brazil.

This beautiful plant has taken possession of many of the broad telephone cuttings through the forest which intersect the Suva road, as it winds up the spurs of Mt. Victoria between Yasoqo and Navai. It would be difficult to exaggerate the magnificent effect of these straight lines, about 5 m. wide, one dense mass of brilliant carmine foliage, bordered by the dark green forest. It runs up through the bordering trees and shrubs to a height of 3 or 4 m., and each branch is terminated by a delicate feathery panicle of white flowers, which enhances the general effect. It is of recent introduction, and its extraordinary rapid increase had been noted by Mr. Adolf Joske, whose unrivalled knowledge of the neighbourhood is united with a keen eye and interest in the local flora. Could people only see such a plant growing naturally and unrestricted, with the added grace of the flowers, it would sound the death knell of horticultural traditions, which would restrict everything to bedding-out limits.

I am indebted to Mr. Spencer Moore for the identification of this plant, which was first flowered in this country by Mr. Herbst, of the Kew Nursery, Richmond, in 1864, and figured in the Bot. Mag. t. 5499.

* Maiden, J. H., in Proc. Linn. Soc. N. S. Wales, xxviii. (1904) 763.

PIPERACEÆ. (C. de Candolle.)

PIPER, *Linn.*

Sectio MACROPIPER, *C. DC.* (Sectio *Potomorphe*, C. DC. in Prodr. xvi. 240 p. p.).—Flores dioici. Spicæ in axillis foliorum vel in apice ramuli axillaris sitæ. Floris masculi stamina 2 lateralia vel 3 quorum duo lateralia, tertium posticum ; floris feminei bacca sessilis.

PIPER MELANOSTACHYUM, *C. DC.*, sp. nov.

Glabrum, foliis modice petiolatis oblongo-ellipticis basi acutis apice longe et acute acuminatis, 5-nerviis ; petiolo usque ad $\frac{1}{2}$ longitudinis vaginante alis marginiformibus apice attenuatis ; stirpis feminei pedunculis in axillis foliorum solitariis quam petioli brevioribus, spicis quam limbi dimidium paullo brevioribus in sicco nigris ; bractea orbiculari parva centro subsessili ; ovario subovato-elliptico, stigmatibus ellipticis.

Suffrutex $1\frac{1}{2}$ m. altus, ramosus, rami 2 mm. crassi ramulique in sicco atrorubescentes ; collenchyma in fasciculos discretos dispositum, zona interna partim libriforme ; fasciculi intramedullares 1-seriati pauci, canalis lysigenus centralis cellulis gelifactis farctus. Limbi in sicco membranacei, virescentes, minute pellucido-punctulati, subtus sparsim nigropunctulati, $8\frac{1}{2}$ cm. longi usque ad 37 mm. lati. Petioli circiter 13 mm., pedunculi 7 mm. longi. Spicæ densifloræ, immaturæ 4 cm. longæ. Bractea $\frac{1}{2}$ mm. diametro. Ovarium sessile.

Hab. Nadarivatu, 2700, terrestrial in forest. Aug. 703.

PIPER MACGILLIVRAYI, *C. DC.*, *Seem. Fl. Vit.* 262, t. 75, var. GLABRUM, *C. DC. Prodr.* xvi. 335.—Frutex 3 m. altus, foliis herbaceis, fructibus rubris.

Nadarivatu, 2700, in forest. Sept. 676.

Var. FASCICULARIS, *Warb. in Engl. Jahrb.* xxv. 609, forma *b*, *C. DC.* n. f. —Frutex erectus 2 m. altus, spicis quam in typo brevioribus, florentibus 2 cm. longis.

Nadarivatu, 2700, in forest. Sept. 677.

PIPER POLYSTACHYUM, *C. DC.*, sp. nov.

P. foliis sat longe petiolatis glabris rotundatis basi cordatis apice breviter acuminatis, 13-pli-nervis ; petiolo paullo infra medium vaginante alis apice ad petiolum attenuatis; stirpis masculi spicis in folii axilla 14 longe pedunculatis vel centralibus ramulo aphyllo insertis et brevius pedunculatis, pedunculis glabris, spicis ipsis quam limbi pluries brevioribus densifloris ; bracteæ pelta rotunda glabra centro pedicellata, pedicello rhachique pilosis, antheris 3 subsessilibus rotundatis.

Frutex 3 m. alt. Ramuli glabri, spiciferi 3 mm. crassi, collenchyma continuum haud libriforme, fasciculi intramedullares altero latere 2-seriati, canalis lysigenus centralis aliique peripherici. Limbi in sicco membranacei, minute pellucido-punctulati, verisimiliter usque ad 18 cm. longi. Spicæ subflorentes, 4½ cm. longæ, 2 mm. crassæ. Bractea 1 mm. diametro. Stamina 3.

Hab. Nadarivatu, 2700, common in forest. Sept. 794.

PIPER GIBBSIÆ, *C. DC.*, sp. nov.

P. foliis modice petiolatis ovato-acuminatis acumine obtusiusculo supra glabris subtus sat dense hirtellis 7-nerviis; petiolo dorso hirtello, alte ultra medium vaginante, alis glabris marginiformibus apice truncatis; stirpis feminei pedunculis in axilla solitariis quam petioli brevioribus et puberulis; spicis limbi dimidium subæquantibus, rhachi hirtella, bractea orbiculari glabra centro pedicellata; ovario obovato hirsuto, stigmatibus oblongo-ellipticis apice subacutis.

Frutex ramosus, rami glabri, circiter 4 mm. crassi, in sicco pallidi, sparsim lenticellosi; ramuli glabri, leviter costulati, collenchyma continuum et haud libriforme, fasciculi intramedullares pauci, 1-seriati, canalis lysigenus centralis. Limbi in sicco membranacei, lutescentes, minute pellucido-punctulati, usque ad 8 cm. longi et 3½ cm. lati. Petioli 10–17 mm. longi. Pedunculi circiter 6 mm. longi. Spicæ florentes 3½ cm. longæ. Stigmata 3 sessilia.—Species ovariis hirsutis insignis.

Hab. Nadarivatu, 1500, dry open slopes of N.W. escarpment. Sept. 722.

PIPER ERECTISPICUM, *C. DC.*, sp. nov.

P. foliis modice petiolatis elliptico-lanceolatis basi æquilatera acutis apice longe et acute acuminatis supra glabris subtus sat dense hirtellis 7-nerviis, nervis lateralibus paullulo supra basin vel a basi ipsa solutis; petiolo hirtello ultra medium vaginante alis glabris superne ad petiolum attenuatis; stirpis feminei spicis in axilla solitariis breviter pedunculatis, ipsis florentibus quam limbi brevioribus, pedunculis quam petioli pluries brevioribus et glabris, rhachi glabra; bractea orbiculari parva centro pedicellata; ovario ovato sparsim piloso; stigmatibus obovatis.

Ramuli glabri, in sicco fusci, spiciferi 1½ mm. crassi, collenchyma subcontinuum zona interna sparsim libriforme, fasciculi intramedullares 1-seriati, canalis lysigenus centralis. Limbi in vivo herbacei, in sicco membranacei, inconspicue pellucido-punctulati, usque ad 13 cm. longi et 58 mm. lati. Petioli 14 mm.; pedunculi 1½ mm. longi. Spicæ in vivo erectæ et albæ, 6 cm. longæ. Bractea diametro ½ mm. Ovarium sessile. Stigmata 3 sessilia brevia.

Hab. Nadarivatu, 2700, in forest. Aug. 599.

PIPER OXYCARPUM, *C. DC.*, sp. nov.

P. foliis modice petiolatis ovatis basi æquilatera rotundatis apice sat longe et acute acuminatis 7-nerviis utrinque longe pilosis; petiolo usque ad medium vaginante dense et longe piloso alis dorso longe pilosis et superne ad petiolum attenuatis; stirpis feminei pedunculis in axilla solitariis adultis petiolos multo superantibus et pilosis, spicis maturis limbos subæquantibus superne attenuato-acutis, rhachi pilosa, bracteæ pelta rotunda margine pedicelloque longe pilosis; ovario ovato sparsim piloso superne longe attenuato-acuto et summo apice minutissime 2-lobulato, bacca ovata longe mucronata.

Frutex 2 m. altus. Ramuli longe pilosi, spiciferi 2 mm. crassi; collenchyma continuum sparsim libriforme, fasciculi intramedullares pauci 1-seriati, canalis lysigenus centralis. Limbi in vivo carnosi, in sicco membranacei et minute pellucido-punctulati, adulti 12 cm. longi, 7 cm. lati, pilis 1 mm. longis. Petioli 2 cm.; pedunculi adulti 5 cm. longi. Spicæ maturæ 11 cm. longæ, inferne cum baccis fere 4 mm. crassæ, rubræ, in vivo pendentes.—Species ovarii et baccæ forma ac stigmatibus veris deficientibus admodum singularis.

Hab. Nadarivatu, 2700, on road to Nadulla, in forest. Aug. 604.

Sectio EUPIPER, *C. DC. in Prodr.* xvi. 1. 339, emend.

PIPER INSECTIFUGUM, *C. DC.*, *Seem. Fl. Vit.* 262; foliis in specimine adhuc juvenilibus, limbis 6 cm. longis, 5½ cm. latis.

Frutex scandens. Folia coriacea læte virescentia. Spicæ pendentes.

Nadarivatu, 2700, common in forest. Sept. 809.

PEPEROMIA, *Ruiz et Pavon.*

A. *Folia alterna.*

Ovarium summo apice stigmatiferum.

PEPEROMIA GIBBSIÆ, *C. DC.*, sp. nov.

Glabra, foliis breviter petiolatis ovato-lanceolatis basi ima acutis apice acuminatis acumine acuto 5-nerviis nervuloque marginali ab apice ultra medium decurrente, subtus in sicco inconspicue nigropunctulatis; pedunculis 3–4 brevibus ramulo axillari aphyllo quam folium multo breviore insertis et squamis ovatis apice acuminatis fultis, spicis densifloris florentibus quam limbi brevioribus; bractea orbiculari centro pedicellata, antheris ellipticis; ovario turbinato in apice rotundato stigmatifero, stigmate minuto glabro.

Herba epiphyta aut terrestris. Caulis inferne radicans, ramuli spiciferi circiter 15 cm. longi, in sicco basi 1¾ mm. crassi. Folia alterna internodiis circiter 16 mm. longis. Limbi in sicco membranacei, usque ad 58 mm. longi et 29 mm. lati. Petioli pedunculique circiter 5 mm. longi. Ramuli aphylli, spiciferi circiter 8 mm. longi. Spicæ florentes fere usque ad 3 cm. longæ paullulo ultra ½ mm. crassæ, quarum infimæ basi ramuli insertæ. Bractea sub ½ mm. diametro.

Hab. Nadarivatu, 2700, in forest. Sept. 883.

PEPEROMIA LASIOSTIGMA, *C. DC.*, sp. nov.

P. foliis breviter petiolatis glabris elliptico-lanceolatis basi et apice attenuato-acutis 5-nerviis, nervis 3 centralibus conspicuis aliis multo tenuioribus; pedunculis petiolos æquantibus glabris, 2–3 ramulo aphyllo insertis et tum squamis linearibus apice acutis fultis aut 1–2 in folii veri axilla, spicis tenuibus bacciferis quam foliorum limbi brevioribus; bractea rotunda centro brevissime pedicellata, filamentis brevissimis antheris ellipticis; ovario rhachi impresso obovato summo apice stigmatifero, stigmate piloso; bacca subglobosa lævi.

Caulis erectus glaber dichotome ramosus, circiter usque ad 2½ mm. crassus. Folia alterna internodiis 2½–3 cm. longis. Limbi in sicco membranacei opaci usque ad 52 mm. longi et 20 mm. lati. Petioli usque ad 4 mm. longi. Spicæ bacciferæ 3½ cm. longæ vix 1 mm. crassæ. Bacca emersa sine pseudocupula sessilis ¾ mm. longa.

Hab. Nadarivatu, 2700, epiphytic in forest. Sept. 890.

Ovarium paullo sub apice oblique stigmatiferum.

PEPEROMIA FLAVIDA, *C. DC.*, sp. nov.

Glabra, foliis breviter petiolatis elliptico-lanceolatis basi et apice acutis, 5-nerviis nervuloque marginali ab apice vix usque ad medium decurrente; pedunculis 3–4 ramulo axillari paniculatim insertis et tum brevibus ac squamis lanceolatis fultis, aut in folii veri axilla geminatis solitariisve et tum sat longis, spicis quam foliorum limbi brevioribus filiformibus densifloris; bractea orbiculari centro breviter pedicellata, antheris ellipticis; ovario emerso obovato sub apice stigmatifero, stigmate minuto glabro; bacca globosa glandulis asperulata.

Herba epiphyta. Rami usque ad 2 mm. crassi foliaque in sicco flavida, nodi sat tumidi atro-rubescentes. Folia alterna. Limbi in vivo carnosi, in sicco rigidi, 3–4 cm. longi, 9–15 mm. lati. Petioli 3 mm., pedunculi 6–8 mm. longi. Spicæ circiter 3 cm. longæ et in sicco 1 mm. crassæ. Bracteæ ½ mm. diametro. Bacca sessilis ½ mm. paullo crassior, sine pseudocupula.

Hab. Between Yasoqo and Navai, 3000, epiphytic in forest. Aug. 549.

PEPEROMIA SUBROSEISPICA, *C. DC.*, sp. nov.

P. foliis elliptico-lanceolatis basi acutis apice longe attenuato-acuminatis acumine obtusiusculo, utrinque glabris, summo apice ciliolatis, subtus in sicco nigropunctulatis, 5-nerviis; petiolo glabro; pedunculis oppositifoliis petiolos superantibus glabris, spicis quam foliorum limbi paullo brevioribus filiformibus densifloris; bractea orbiculari centro subsessili, antheris rotundatis; ovario emerso obovato paullo sub apice oblique stigmatifero, stigmate minuto glabro; bacca globosa.

Herba rupestris inferne radicans. Ramuli glabri in sicco usque ad 1 mm. crassi. Folia alterna internodiis 9 mm. longis. Limbi in vivo carnosi et læte virescentes in sicco membranacei, superi usque 4 cm. longi et 12 mm. lati Petioli 2 mm., pedunculi 6 mm. longi. Spicæ maturæ in vivo subroseæ, 36 mm. longæ, $\frac{3}{4}$ mm. crassæ. Bractea diametro sub $\frac{1}{2}$ mm. Bacca sessilis $\frac{1}{2}$ mm. crassa, sine pseudocupula.

Hab. Nadarivatu, 3300, on volcanic agglomerate, summit of ridge. Sept. 726.

Peperomia carnosa, *C. DC.*, sp. nov.

Glabra, foliis breviter petiolatis elliptico-lanceolatis basi cuneatis apice acute et sat longe acuminatis, 5-nerviis nervuloque marginali ab apice ultra medium decurrente, subtus in sicco nigropunctulatis; pedunculis axillaribus brevibus, spicis quam folia brevioribus densifloris; bractea orbiculari centro subsessili, antheris ellipticis; ovario rhachi impresso obovato sub apice oblique stigmatifero, stigmate minuto glabro.

Herba epiphyta vel terrestris, carnosa. Caulis inferne radicans, usque ad 3 mm. crassus, inde erectus et circiter 25 cm. altus. Folia alterna internodiis fere 15 mm. longis. Limbi in vivo carnosi, in sicco rigido-membranacei, sparsim pellucido-punctati, fere 7 cm. longi et 29 mm. lati. Petioli 7 mm., pedunculi fere 5 mm. longi. Spicæ florentes, 3 cm. longæ, in sicco 1 mm. crassæ. Bracteæ $\frac{1}{2}$ mm. diametro.

Hab. Nadarivatu, 2700, in forest. Sept. 600.

Peperomia curtispica, *C. DC.*, sp. nov.

P. foliis breviter petiolatis ellipticis basi acutis apice obtusis, 3-nerviis nervuloque marginali ab apice vix usque ad medium decurrente, supra glabris subtus junioribus minute puberulis dein glabris, petiolo minute puberulo, pedunculis axillaribus terminalibusque quam petioli longioribus glabris, spicis limbos subæquantibus sublaxifloris; bractea orbiculari centro subsessili, antheris ellipticis; ovario emerso ovato summo apice stigmatifero, stigmate bilobo, lobis rotundatis antero-posticis inæqualibus margine pilosis; bacca globosa glandulis conspersa.

Herba epiphyta. Ramuli in sicco $\frac{1}{2}$ mm. crassi, minute puberuli. Folia alterna internodiis 5 mm. longis. Limbi in sicco membranacei læte, virescentes, superi usque ad 15 mm. longi et 9 mm. lati. Petioli superi $\frac{1}{2}$ mm., pedunculi 3 mm. longi. Spicæ maturæ circiter 14 mm. longæ et 1 mm.

crassæ. Bractea sub ½ mm. diametro. Bacca sessilis ¾ mm. crassa, sine pseudocupula.

Hab. Nadarivatu, 2700, on trees in forest. Sept. 651.

B. *Folia verticillata.*

Peperomia vitiana, *C. DC. Prodr.* xvi. 1. 458.

Viti (*Seemann*, 565).

This species has been added, so that all the Piperaceæ hitherto collected in the Fijian Islands are enumerated in this paper. Two species of *Piper* (*P. Gibbsiæ* and *P. oxycarpum*) are very curious on account of their hairy ovaries, a character which is very rare in the genus. Amongst the Peperomias which are all new, three (*P. Gibbsiæ*, *lasiostigma*, *flavida*) are particularly interesting as their spikes are inserted in the axils of imperfect leaves, a disposition also found in two New Hebrides Peperomias sent to me by Prof. Maiden, otherwise entirely different.

MONIMIACEÆ.

Hedycarya dorstenioides, *A. Gray, in Journ. Bot.* iv. (1866) 83.

Nadarivatu, 2700, clearing on edge of forest. ♂ ♀. Fr. Aug. 583, 882

Distrib. Fiji (Viti Levu, Ovalau), Samoa.

A small tree, 7·8 m., of neat habit, with coriaceous shining leaves and yellow flowers. The fruit when collected was green, smooth and shining (*Powell*, 199, Samoa, in bloom and fruit, July ; Herb. Kew.).

THYMELIACEÆ.

Wikstroemia viridiflora, *Meissn. in Denkschr. Bot. Ges. Regensb.* iii. (1841) 286.

Nadarivatu, 2700, open scrub on edge of escarpment. Fl. & Fr. Aug 553.

Distrib. Fiji, Tahiti, Samoa, Hawaii, Philippines, Marquesas, N.E. Australia, New Caledonia to S.E. China and Malaya.

Leucosmia acuminata, *A. Gray, in Journ. Bot.* iii. (1865) 306.

Nadarivatu, 2700, in mixed forest. Fl. Sept. 608.

Distrib. Fiji (Viti Levu, Taviuni), Samoa and Tonga.

A most exquisite shrub, with corymbs of long, white, sweet-scented flowers massed in the axils of the leaves, up the erect branches. It is very abundant, and a great favourite with the Fijians, who strip off the bark with the leaves and flowers to make up into garlands.

LORANTHACEÆ.

LORANTHUS INSULARUM, *A. Gray, Bot. U.S. Expl. Exp.* 738, t. 98.

Nadarivatu, 2700, on trees in forest, very common. Fl. Aug.–Sept. 579.

Distrib. Fiji (Viti Levu, Vanua Levu, Taviuni, Nairai), Samoa, Tonga, Rarotonga. Loyalty Islands.

Apparently varies in the size of the flowers. (Collected in flower by Mr. Cheeseman in Rarotonga in May, June, and July.)

EUPHORBIACEÆ.

EUPHORBIA PILULIFERA, *Linn. Sp. Pl.* 454.

Road to Waikubakuba, 1000, on cultivated land. Fl. & Fr. Sept. 691.

Distrib. A common tropical weed.

PHYLLANTHUS SIMPLEX, *Retz. Obs.* v. 29.

Nadarivatu, 1500, on road to Waikubakuba, cultivated ground. Fl. & Fr. Sept. 689.

Distrib. South-east Asia and Polynesia. Weed of cultivation.

GLOCHIDION CORDATUM, *Seem. Bonplandia*, ix. (1861) 259.

Nadarivatu, 2700, on cleared ground. Fl. & Fr. Sept. 771.

Distrib. Fiji (Viti Levu, Ovalau).

A small tree or shrub, 4 m. high, with densely branching habit and green flowers.

GLOCHIDION ANFRACTUOSUM, sp. nov. (Pl. **15**. figs. 24–29.)

Frutex, ramulis junioribus anfractuosis, foliosis, brunneo-velutinis, tandem puberulis; foliis petiolatis, late ovatis, breviter cuspidatis, apice acutis, integerrimis, costa centrali utrinque pubescente exclusa glabris, internodiis 3-plo longioribus, basi rotundatis, nequaquam cordatis; stipulis late ovatis, breviter acuminatis; floribus axillaribus; floribus ♂ paucis glomeratis, pedicellatis; perianthio ♂ piloso basi ciliato, phyllis 6; staminibus 6, sessilibus, connectivis productis; floribus ♀ in eadem axilla 2–4, breviter pedicellatis; perianthio ♀ 6-mero, lobis ovato-rotundatis, puberulis; ovario 6-loculari, stylis brevibus crassis; capsula valde depressa, pube sparsa brunnea onusta.

Hab. Col i Nadarivatu, 3000, in open clearing with secondary scrub. Fl. & Fr. Sept. 730.

A shrub, 1½ m. or more in height; densely branching, with the leaves aggregated towards the ends of the branches, forming a bushy top. The leafy shoots take a strongly marked zigzag course. The petioles are 4 m. in length, the blades of the leaves 7 cm. long and 4 cm. broad, while the small ovate stipules are 1 mm. long. and 1·5 mm. broad. The flowers are aggregated 3–8 in the axils of the leaves; the ♂ yellow-green on pedicels ± 4 mm. long, with the outer petals spreading, 2·5 mm. long and 2 mm. broad, while the inner are erect and narrower, more or less enclosing the staminal column. The ♀ flowers are shortly pedicellate, 2 mm., elongating to 4 mm. in fruit. Both the ovary and style are red in colour, 3 mm. long and 2 mm. broad, and very puberulous. The capsule is 11 mm. across and 5 mm. long.

This species is allied to *G. cordatum*, Seem., from which it can be easily distinguished by the zigzag branching nodes, the glabrous and petiolate leaves, not cordate at the base, and the roundly ovate, shortly acuminate stipules.

CROTON VERREAUXII, *Baill. Etud. Gén. Euphorb.* 357.

Nadarivatu, 2700, N.W. escarpment, fringe of forest. Fl. & Fr. Aug. 562.

Distrib. Fiji (Ovalau). E. trop. Australia, New Guinea, and Philippines.

A shrub to small tree, 2–3 m. high, with shining coriaceous leaves, the young foliage being a tender yellow-green. Flowers green, the perianth of the ♀ enlarging in fruit. This plant was plentiful at Nadarivatu, on the N.W. edge of the escarpment, but it has not been collected since Storck found it in Ovalau, and on his specimen the var. *Storckii*, Müll. Arg., was based.

CLAOXYLON ECHINOSPERMUM, *Müll. Arg. in DC. Prod.* XV. II. 787.

Nadarivatu, 2700, forest. ♂. Aug. 670. ♀. Aug. 585.

Distrib. Fiji (Ovalau).

Shrub to small tree, 3 to 10 m. high, with dull glabrous, herbaceous leaves and minute green flowers.

ACALYPHA INSULANA, *Müll. Arg. in Flora*, xlvii. (1864) 439. Var. *a.* STIPULARIS, *Müll. Arg.*

Navai, 3000, in forest. Fl. Sept. 787.

Distrib. Fiji.

Collected from young plant, 2 m. high, consisting of a single shoot, with leaves all down it, 3–4 dm. long at the base. On older branched trees the leaves would be very much smaller.

ACALYPHA INSULANA, *Müll. Arg. in Flora*, xlvii. (1864) 439. Var. *γ.* GLABRESCENS, *Müll. Arg.*

Nadarivatu, 2700, N.W. escarpment, fringe of forest. Fl. Aug. 589, 590 bis.

Distrib. Fiji (Viti Levu).

ACALYPHA REPANDA, *Müll. Arg. in Flora*, xlvii. (1864) 439.

Nadarivatu, 2700, forest. Fl. Oct. 709.

Distrib. Fiji (Viti Levu).

HOMALANTHUS NUTANS, *Guill. Zeph. Tahit.* 35.

Nadarivatu, 2700, clearings in forest, and open country. Fl. Aug. 622, 641 bis.

Distrib. Fiji (Viti Levu, Ngau), Tonga, Tahiti, Loyalty Islands, and New Hebrides.

A very graceful tree, apparently at home in all situations. If introduced into cultivation it would form a pleasing variety to the ubiquitous *Schinus Molle*, *Melia Azedarach*, and *Eucalyptus* sp. of tropical and subtropical planting.

URTICACEÆ.

PARASPONIA ANDERSONII, *Planch. in DC. Prod.* xvii. 195.

Nadarivatu, 2700, mixed forest. ♂. Sept. 863.

Distrib. Fiji, Tonga, Tahiti, New Hebrides, and New Caledonia.

GIRONNIERA CELTIDIFOLIA, *Gaud. Bot. Voy. Bonite*, t. 85.

Nadarivatu, 2700, in mixed forest, common. ♂. Fr. Sept. 616.

Distrib. Fiji (Viti Levu, Ovalau), Samoa; Philippines and Admiralty Islands.

FICUS HARVEYI, *Seem. Fl. Vit.* 250.

Nadarivatu, 2700, in forest. Fl. Sept. 617.

Distrib. Fiji (Viti Levu).

A large tree, 20 m. in height, with coriaceous dark green leaves. The species is founded on Seemann's specimens (444 and 440, Herb. Kew.). This is the second record.

FICUS OBLIQUA, *Forst. f. Prod.* 77.

Nadarivatu, 2700, in mixed forest. Fl. & Fr. Oct. 818.

Distrib. Fiji (Viti Levu, Taviuni), Tonga, New Hebrides.

A large and handsome tree with flat crown and white trunk and roots. Usually beginning life as an epiphyte, it finally supplants the host. Fruit yellow.

FICUS SCABRA, *Forst. f. Prod.* 76.

Nadarivatu, 2700, in mixed forest. Fl. & Fr. Oct. 841.

Fiji (Ovalau), Tonga, New Hebrides.

A small tree 9 m. in height, with yellow fruit.

PELLIONIA VITIENSIS, *A. Gray, ex Wedd. in DC. Prod.* xvi. I. 167.

Nadarivatu, 1700, road to Waikubakuba. ♂. Sept. 693.

Distrib. Fiji (Viti Levu, Ovalau).

Shrub, 2 m. high, the ♂ flowers red. Weddell describes the inflorescence as being long peduncled with one glomerule; in my specimens there are groups of five glomerules at regular intervals up the peduncle.

PELLIONIA ELATOSTEMOIDES, *Gaud. in Bot. Freyc. Voy.* 494, t. 119.

Waikubakuba Valley, 500, on banks of stream. ♂ ♀. Sept. 725.

Distrib. Fiji (Viti Levu, Taviuni, Ovalau), Rarotonga. Philippines and Solomon Islands, Marquesas, Moluccas, and New Guinea.

Described by Weddell as dioicous this plant is also monoicous, as ♂ and ♀ flowers may occur on the same shoot, or one shoot may be sometimes entirely ♂. It is herbaceous, growing from 1–3 m. in height, the alternate large and fleshy light green leaves being arranged pinnately up the stem. The flowers are white or pink (also noted by Horne) and are very pretty on the ♂ branches. The habit is very like that of *Elatostema macrophyllum*, the clumps of single shoots being all inclined in the same direction. The flowers are fertilized by ants. It is very general as herbaceous undergrowth in the forest.

ELATOSTEMA SESSILE, *Forst. Char. Gen.* 106.

Vatavula, 1000, top of Nabucara Hill, in forest. ♀. Aug. 523. Col i Nadarivatu, 3000. 633.

Distrib. Samoa, Tahiti, Solomon Islands. Asia and trop. Africa.

This widely distributed plant has not previously been recorded for Fiji.

ELATOSTEMA FRUTICOSUM, sp. nov. (Pl. **16**. figs. 30–40.)

Planta glabra, basi lignosa; foliis oppositis, petiolatis, oblique obovato-lanceolatis, tenuiter membranaceis, sub-abrupte acuminatis, crenato-serratis, basi obliquis, sæpius levissime cordatis, penninerviis, nervis lateralibus 3–4 ascendenti-arcuatis, supra glabris, subtus ad nervos minute pubescentibus; stipulis membranaceis, pilosis, caducis; receptaculis axillaribus solitariis, capitatis, subsessilibus; masculorum bracteis exterioribus ovatis, 3-partitis, mucronatis, mucrone pilis rigidis instructo, bracteolis hyalinis, cucullatis ciliatis, perigonii 4-partiti; lobis acuminatis; capitulis femineis masculis minoribus, involucris pubescentibus, fimbriato-ciliatis, mucronatis, bracteolis linearibus spathulatis, longe ciliatis; perigoniis 4-partitis, segmentis oblongis obtusis inflexis.

Hab. Nadarivatu, 2700, undergrowth in forest. Fl. Aug. 609. Sept. 678.

A shrubby herbaceous plant, branching freely, 1–3 m. high. The petioles are 6–8 mm. long and the leaves 12 cm. long and 4·7 cm. broad, with a large number of linear cystoliths visible upon the upper side. The ♂ and ♀ receptacles are opposite, but the ♂, which are smaller, occur towards the base of the shoots. The ♂ receptacle is 1 cm. long and 6 mm. broad and stands upon a relatively stout stalk not quite 1 mm. in length; the pedicels of the flowers are 1 mm., the petals 5·5 mm. and the anthers 1·5 mm. long, the hooded bracteoles being ± 3 mm. long and varying in breadth. The ♀ receptacle is 5 mm. across and its flowers are almost sessile, the pedicel and perianth measuring not more than 1 mm. together; the perianth leaves are normally reflexed, when elongated they are 1 mm. in length. The capsule is 1 mm. long and is clothed with brown hairs.

This species is nearest to *E. sessile*, Forst., but differs in the shrubby habit, petiolate and broader leaves with very narrow and slightly cordate base, and the sessile flowers and fruit.

There is a specimen of this plant at the Herb. Kew. collected by Horne, labelled "Not common, near Wai Dradra, Viti Levu, grows 4–6 ft. in height. 991."

ELATOSTEMA MACROPHYLLUM, *Brongn. Bot. Voy. Coq.* 207, t. 45.

Nadarivatu, 3000, soak areas and banks of streams in mixed forest, general. ♂ ♀. Fr. Sept. 862.

Distrib. Fiji (Viti Levu); Amboyna and Java.

A handsome herbaceous plant, which throws up single shoots 0·5–1·50 m. in height. The large leaves, showing dorsiventral symmetry, occur towards the apex of the shoots, which are all inclined in the same direction. This plant always forms large patches, taking up the soak areas of mountain streams, and is also an important constituent of the herbaceous undergrowth of the mixed forest.

PROCRIS MONTANA, *Steud. Nomencl.* ed. 2, ii. 398.

Nadarivatu, 2700, epiphyte in forest. ♂. Sept. 735. ♀ & Fr. Sept. 661.

A fleshy herbaceous plant with pendent branches, 5–6 cm. long. The leaves are dark green and shining, the ♂ flowers white, produced on axillary peduncled paniculate cymes, while the ♀ are aggregated in small green axillary receptacles which enlarge, becoming red and gelatinous in fruit.

This is evidently the plant described by Bauer as *Elatostema montanum*, from Norfolk Island. The description agrees with my specimens, especially in the broad cinnabar-brown seeds, which distinguish it from the widely spread *P. cephalida*, Comm. It is described as a "tree" by Bauer, which is obviously a mistake.

Boehmeria platyphylla, *D. Don, Prod. Fl. Nep.* 60.

Nadarivatu, 2500, forest. ♂ ♀. Aug., Sept. 638.

Distrib. Fiji (Viti Levu, Vanua Levu, Kadavu, Ovalau, Ngau), Samoa, Tahiti. Asia and trop. Africa.

Pipturus argenteus, *Wedd. in DC. Prod.* xvi. i. 235 19.

Mataculi, 1500, forest. ♂. Sept. 835.

Distrib. Oceania, E. trop. Australia and Malaya.

Pipturus velutinus, *Wedd. in Ann. Sci. Nat.* sér. 4, i. (1854) 196.

Nadarivatu, between Yasoqo and Navai, 3000, forest. ♀. Aug. 544.

Distrib. Fiji (Viti Levu, Ngau), Tonga, Rarotonga, Tahiti, Marquesas, New Caledonia; Java, Timor, and Amboyna.

Maoutia australis, *Wedd. in Arch. Mus. Par.* viii. (1855–56) 480.

Nadarivatu, 2700, in mixed forest. Fl. Sept. 639.

Distrib. Fiji (Viti Levu, Taviuni, Navai, Matuku, Ovalau, Vanua Levu), Samoa and Tahiti.

CASUARINACEÆ.

Casuarina equisetifolia, *Linn. Amœn. Acad.* iv. 143 (equisefolia).

Island of Ovalau, beach. Oct. 861.

Distrib. Fiji, Tonga, Rarotonga, Tahiti, Marquesas; and tropical shores of Asia, Africa, and Australia.

Casuarina nodiflora, *Forst. f. Prod.* 64.

Nadarivatu, 2700, in mixed forest. 770.

Distrib. General in Fiji, also in New Caledonia.

ORCHIDACEÆ. (Mr. R. A. Rolfe.)

Microstylis vitiensis, *Rolfe*, sp. nov.

Caules breves, vix incrassati. Folia petiolata, elliptico-lanceolata, acuta, 5–7-nervia, membranacea; limbus 6–13 cm. longus, 2–3·5 cm. latus; petiolus 2–3 cm. longus, vaginatus. Scapi erecti, subgraciles, 15–20 cm. longi. Bracteæ patentes, lanceolatæ vel ovato-lanceolatæ, acutæ vel acuminatæ, 4–5 cm. longæ. Pedicelli graciles, 3–4 mm. longi. Sepala libera, elliptico-oblonga, obtusa, trinervia, 4 mm. longa. Petala linearia, obtusa, uninervia, 4 mm. longa. Labellum trilobum, 5–6 mm. latum; lobus intermedius quadratus, obtusissimus, infra 1 mm. longus; lobi laterales elliptico-oblongi, utrinque obtusi, 3·5–4 mm. longi; discus callo transverso arcuato instructus. Columna 1 mm. longa, alis obtusis. Capsulæ pedicellatæ, obovoideæ, hexagonæ, 1 cm. longæ, costis undulatis.

Hab. Col i Nadarivatu, 3500, in moss forest. Fl. & Fr. Sept. 653.

Differs from *M. platychila*, Reichb. f., in its narrower leaves, shorter inflorescence, and in the structure of the flowers. Flowers orange-green.

Dendrobium Gordoni, *S. Moore in Journ. Linn. Soc., Bot.* xx. (1883) 372.

Nadarivatu, 2700, on trees in forest. Fl. Sept. 603.

Distrib. Fiji (Viti Levu), Samoa.

A handsome species, with yellow-green flowers, splashed with brown.

Dendrobium Mohlianum, *Reichb. f. in Bot. Zeit.* xx. (1862) 214.

Nadarivatu, Mt. Victoria, 3500, in forest. Fl. Sept.–Oct. 620.

Distrib. Fiji (Kadavu, Viti Levu).

General on all the mountain ridges, above 3000 ft. Flowers brilliant orange.

Dendrobium prasinum, *Lindl. in Journ. Linn. Soc., Bot.* iii. (1859) 11.

Nadarivatu, 2700, epiphytic in forest, general. Fl. Sept. 663.

Distrib. Fiji (Kadavu).

A very charming species, with conspicuous white flowers, generally growing in tufts, often 2–3 dm. through, in the forks of trees. It was described by Lindley from a drawing by Agati, in the possession of Prof. Asa Gray, the specimen delineated having been collected in Fiji, at an altitude of 2000 ft. It was subsequently collected by Seemann on Buke Levu, Kadavu (Herb. Kew.). It was very general about Nadarivatu, and also seen at Navai, 7 miles from there.

Dendrobium sertatum, *Rolfe*, sp. nov.

Caules elongati, angulati, foliacei, 45–60 cm. longi. Folia oblongo-lanceolata, acuta, submembranacea, 12–14 cm. longa, circa 1·5 cm. lata. Flores fasciculati vel brevissime racemosi, numerosi, parvi. Bracteæ oblongo-lanceolatæ, acuminatæ, 5–8 mm. longæ. Pedicelli graciles, circa 1 cm. longi. Sepala et petala subconniventia, oblonga, acuta, 7–8 mm. longa. Labellum elliptico-oblongum, apiculatum, concavum, circa 1 cm. longum. Mentum oblongum, obtusum, 5 mm. longum. Columna lata, 2 mm. longa.

Hab. Ridge of Matani Siga, 3200, in forest. Fl. Sept. 610.

An ally of *D. viridiroseum*, Reichb. f. The habit of the plant is very similar to *D. calcaratum*, A. Rich., but the flowers are borne in fascicles or short arrested racemes on the old pseudobulbs, and individually are much

like those of *D. secundum*, Lindl. The old pseudobulbs are wreathed in flowers, in allusion to which the specific name is given. Flowers of a delicate pinky white.

CHRYSOGLOSSUM GIBBSIÆ, *Rolfe*, sp. nov.

Rhizoma validum. Pseudobulbi ovoidei, 2–3 cm. longi, monophylli. Folia longe petiolata, elliptico-oblonga, acuminata, plicata, membranacea, 5-nervia, circa 20 cm. longa, 6 cm. lata; petioli circa 8 cm. longi. Scapi erecti, circa 60 cm. alti, vaginis paucis vestiti; racemi laxiflori. Bracteæ lineari-lanceolatæ, acuminatæ, circa 1 cm. longæ. Pedicelli 1·5–2 cm. longi. Flores "lutei." Sepalum posticum lanceolatum, acutum, 1·3–1·7 cm. longum; lateralia falcato-lanceolata, acuta, 1–1·3 cm. longa. Petala lanceolato-oblonga, falcata, acuta, 1–1·3 cm. longa, sepalis paullo latiora. Labellum trilobum, circa 1 cm. longum, basi utrinque auriculatum; lobi laterales late oblongi, obtusi, 4–5 mm. longi; lobus intermedius obovato-orbicularis, obtusus, concavus, 5 mm. longus; discus tricarinatus, carinis lateralibus undulatis et longe extensis, carina intermedia parva. Columna arcuata, 4–5 cm. longa, alis triangularibus subacutis infra medium instructa.

Hab. Nadarivatu, 2700, in forest. Fl. Sept. 886.

About twice as tall as *C. vesicatum*, Reichb. f., the other Philippine species of the genus, and more like the Indian *C. erraticum*, Hook. f., in habit.

PHREATIA VITIENSIS, *Rolfe*, sp. nov.

Herba epiphytica, cæspitosa, nana, circa 5–6 cm. alta. Folia linearia, subobtusa, subcoriacea, 4–6 cm. longa, circa 2 mm. lata, basi vaginata, latiora et imbricata. Scapi graciles, circa 2 cm. longi, puberuli; spicæ multifloræ. Bracteæ ovatæ, acuminatæ, 0·75 mm. longæ. Pedicelli 1 mm. longi. Flores "viridi-albi." Sepala ovata, apiculata, 1 mm. longa. Petala oblongo-lanceolata, subacuta, 1 mm. longa. Labellum obovato-oblongum, truncatum vel subbilobum, 1 mm. longum. Columna brevissima.

Hab. Nadarivatu, 2700, on trees in forest. Sept. 619.

A very small species, not unlike *P. pachyphyta*, Schlechter, in stature, but having much narrower leaves.

EARINA LAXIOR, *Reichb. f. Otia Bot. Hamb.* 54 (1878).

Nadarivatu, 2700, forming large clumps in the forks of trees, very common. Sept. 586.

Distrib. Fiji, Tonga, Tahiti, New Caledonia.

A most peculiar inflorescence consisting of a spike terminating with ladder-like branches at right angles to the rhachis, for about a quarter of its length. Only the persistent old spikes and very immature young ones were to be found in August, September, and October; but a specimen of Horne's (Herb. Kew.) labelled "Viti Levu, June," bears flowers.

GLOMERA GIBBSIÆ, *Rolfe*, sp. nov.

Caules elongati, cylindrici, subgraciles, foliosi, 30–45 cm. longi. Folia oblongo-lanceolata, acuta, subsessilia, subcoriacea, 7–10 cm. longa. Capituli terminales, congesti, circa 1·5 cm. longi, basi vaginis ovato-lanceolatis tecti. Bracteæ oblongæ, obtusæ, membranaceæ, circa 8 mm. longæ. Pedicelli circa 7 mm. longi. Sepala et petala oblonga, subobtusa, 5-nervia, 1 cm. longa. Labellum columnæ adnatum, basi saccatum; limbus oblongus, truncatus, leviter recurvus, 3 mm. longus; saccus 3 mm. longus. Columna brevis, lata.

Hab. Near summit, Mt. Victoria, 3800, in Rain Forest. Fl. Sept. 807.

Readily distinguished from *G. samoensis*, Rolfe, by its much broader leaves. The flowers are white.

SARCOCHILUS GRACILIS, *Rolfe*, sp. nov.

Herba epiphytica, pusilla, cæspitosa, circa 8 cm. alta. Folia linearia, obtusa, subcoriacea, 6–8 cm. longa, 2–3 mm. lata, uninervia. Scapi graciles, flexuosi, asperuli, circa 5 cm. longi, pauciflori. Bracteæ ochreatæ, latæ, circa 0·5 cm. longæ. Pedicelli breves. Sepala et petala ovato-oblonga, subobtusa, 1–5 cm. longa. Labellum subsessile, 1·5 cm. longum, trilobum; lobi laterales brevissimi, lati, obtusi; lobus intermedius triangularis, subacutus; calcar oblongum, 1 mm. longum. Columna lata, 0·75 mm. longa. Capsula elliptico-oblonga, rugulosa, 8 mm. longa.

Hab. Nadarivatu, 3500, on ridge, in forest. Fl. & Fr. Sept. 727. Flowers and fruit green.

TÆNIOPHYLLUM FASCIOLA, *Reichb. f. in Seem. Fl. Vit.* 296.

Suva, on trees in Botanical Garden. Very common. Fr. Oct. 885.

Distrib. Fiji, Samoa, Tonga, Tahiti.

ANŒCTOCHILUS VITIENSIS, *Rolfe*, sp. nov.

Rhizoma repens, subgracile. Folia petiolata, late ovata, subacuta, membranacea, olivaceo-brunnea, aureo-maculata, 3–4 cm. longa, circa 2·5 cm. lata; petioli circa 1·5 cm. longi. Scapi erecti, circa 15 cm. alti, pubescentes, vaginis spathaceis paucis instructi, pauciflori. Bracteæ lanceolatæ, acuminatæ, pubescentes, circa 1·5 cm. longæ. Pedicelli circa 1 cm. longi. Sepala elliptico-lanceolata, acuminata, concava, pilosa, 1–1·2 cm. longa; lateralia patentia. Petala lineari-lanceolata, acuta, 1-nervia, cum sepalo postico in galeam conniventia. Labellum trilobum, circa 1·5 cm. longum; lobi laterales anguste oblongi, truncati, 8 mm. longi; lobus intermedius oblanceolatus, acuminato-apiculatus, 5 mm. longus; unguis margine crenulato; calcar oblongum, 2 mm. longum. Columna 7 mm. longa. Capsula elliptico-oblonga, 2 cm. longa.

Hab. Nadarivatu, 2700–3300, in forest. Fl. Sept. 635.

Markedly different from its allies in the shape of the lip, and in having the usual teeth on the unguis reduced to mere crenulations.

This species is conspicuous amidst the forest undergrowth from its exquisite iridescent velvety brown-green leaves, rather fleshy in consistency.

ADENOSTYLIS VITIENSIS, *Rolfe*, sp. nov.

Rhizoma repens, gracile. Caules subgraciles, parce pubescentes, breves. Folia breviter petiolata, oblongo-lanceolata, acuta, membranacea, 4–7 cm. longa, 8–12 mm. lata; petioli 1–1·5 cm. longi, basi vaginati. Scapi circa 30 cm. longi, graciles, pubescentes, pauciflori, vaginis spathaceis paucis vestiti. Bracteæ ovato-lanceolatæ, acuminatæ, pubescentes, 6–8 mm. longæ. Pedicelli 5–6 mm. longi. Flores "albi." Sepala ovato-oblonga, apiculata, 1-nervia, 4 mm. longa, posticum cum petalis in galeam connata. Petala lanceolato-oblonga, acuta, 4 mm. longa. Labellum 3·5 mm. longum, basi concavum, apice dilatato-bilobum; lobi divergentes, obovato-oblongi, obtusi, 3 mm. longi. Columna brevis.

Hab. Nadarivatu, 2700, undergrowth in forest. Fl. Sept. 618.

ADENOSTYLIS STRICTA, *Rolfe*, sp. nov.

Rhizoma repens, crassiusculum, submoniliforme; internodii 7 mm. longi. Caules breves, foliacei. Folia numerosa, subsessilia, lanceolata, acuminatissima, membranacea, 12–15 cm. longa, 1–1·5 cm. lata, basi attenuata, vaginata. Scapi 35–40 cm. longi, erecti, pubescentes, vaginis lanceolatis acuminatis vestiti. Bracteæ lanceolatæ, acuminatissimæ, trinerviæ, 8–10 mm. longæ. Pedicelli 5 mm. longi. Sepala patentia, ovato-oblonga, subacuta, uninervia, 4 mm. longa. Petala lineari-oblonga, obtusa, uninervia, 4 mm. longa. Labellum 3–4 mm. longum, basi ample ventricosum, crassiusculum, margine involutum, apice dilatatum, bilobum, intus bicallosum; lobi sessiles, divergentes, oblongi, membranacei, circa 1 mm. longi. Columna lata, 2 mm. longa.

Hab. Vatavula, Nabacara Hill, 1000, amongst undergrowth in forest. Fl. Aug. 667.

Characterized by the strict habit, very fleshy ventricose base of the lip, and sessile diverging side lobes.

ODONTOCHILUS LONGIFLORUS, *Benth. et Hook. f., ex Drake, Ill. Fl. Ins. Mar. Pacif.* 312 (1892).

Nadarivatu, 2700–3500, terrestrial in forest, scattered. Fl. Sept.–Oct. 701.

Distrib. Fiji (Viti Levu, Taviuni).

A delicate little species, fleshy in consistency, with lovely velvety green leaves of metallic appearance, veined with lighter green; flowers white.

HABENARIA TRADESCANTIFOLIA, *Reichb. f. in Seem. Fl. Vit.* 293.

Nadarivatu, 2700, terrestrial in forest. Fl. Sept. 659.

Distrib. Fiji (Ovalau, Taviuni).

Flowers green, very general.

HABENARIA SUPERFLUA, *Reichb. f. in Seem. Fl. Vit.* 293.

Col i Nadarivatu, 3200, terrestrial in forest. Fl. Sept. 652.

Distrib. Fiji (Ovalau, Taviuni).

Flowers green.

LILIACEÆ.

SMILAX VITIENSIS, *A. DC. Monogr. Phan.* i. 204.

Nadarivatu, 2700, chiefly in clearings, general. ♂ ♀. Fr. Sept. 645.

Distrib. Fiji (Vanua Levu, Ovalau, Kadavu).

The ♀ flower of this plant has not previously been collected.

GEITONOPLESIUM CYMOSUM, *A. Cunn. in Bot. Mag.* t. 3131.

Nadarivatu, 2700, running up the highest trees in the mixed forest, abundant. Fl. & Fr. Aug. 564.

Distrib. Fiji (Kadavu, Viti Levu); Norfolk Island; N.E. Australia.

Very variable in the size and shape of the leaves on different plants. The fruit is orange in colour with black seeds.

CORDYLINE TERMINALIS, *Kunth in Abh. Akad. Berl.* (1842) 30.

Navai, 2500, by path in forest. Fl. Sept. 781.

Distrib. Polynesia to Kermadec Islands; N.E. Australia, Malaya.

DIANELLA NEMOROSA, *Lam. Encyc.* ii. 276; *Jacq. Hort. Schoenb.* t. 94.

Nadarivatu, 2900, open dry hillsides, abundant. Fl. & Fr. Aug. 573.

Distrib. Fiji, Tonga, Hawaii, New Caledonia, E. Australia. Tropical Asia and Mascarene Islands.

DIANELLA INTERMEDIA, *Endl. Prod. Fl. Norf.* 28.

Nadarivatu, 2900, open dry hillsides. Fl. Aug. 574.

Distrib. Fiji, Tonga, Tahiti, and Rarotonga; Norfolk Island.

PANDANEÆ.

PANDANUS JOSKEI, *Balf. f. in Journ. Linn. Soc., Bot.* xx. (1884) 416.

Nadarivatu, 2700, in mixed forest. ♀. Oct. 871.

Distrib. Fiji (Viti Levu).

A very graceful and characteristic species of palm-like habit, common about Nadarivatu. The slender unbranched stem, without stilt roots, runs up with the forest trees to a great height. It was described by Professor Balfour from Horne's notes, as the latter brought back no material. This omission was rectified by Sir John Thurston, who sent a very good series collected by Yeoward to the Kew Herbarium.

Freycinetia Milnei, *Seem. Fl. Vit.* 283, t. 86.
Nadarivatu, 2700, on trees in forest. ♀. Sept. 777.
Distrib. Fiji (Viti Levu, Vanua Levu).

Freycinetia Pritchardii, *Seem. Fl. Vit.* 283, t. 84.
Nadarivatu, 2700, on trees in forest. ♀. Oct. 842.
Distrib. Fiji (Viti Levu), Samoa.

Freycinetia Storckii, *Seem. Fl. Vit.* 283, t. 85.
Nadarivatu, 2700, on trees in forest. ♀. Sept. 870.
Distrib. Fiji (Viti Levu, Taviuni), Samoa, Tonga.

CYPERACEÆ. (Dr. A. B. Rendle.)

Kyllinga monocephala, *Rottb. Descr. et Ic.* 13, t. 4.
Nadarivatu, 2700, damp places in forest. Fl. Sept. 682.
Distrib. Fiji, Samoa, Tonga, Rarotonga, Tahiti, and Hawaii.
A weed throughout the Tropics of the Old World.

Rynchospora aurea, *Vahl, Enum.* ii. 229.
Nadarivatu, 2000, slopes of Koro Levu, open country. Fl. 869.
Distrib. Fiji, Tahiti. Tropics of both hemispheres.

Gahnia vitiensis, *Rendle*, sp. nov. (Pl. **13.** figs. 18–20.)

Planta 5-pedalis, caule terete scabridulo vaginis foliorum pro majore parte obtecto; foliis rigidis convolutis, in nervis scabridis, superne gradatim attenuatis demum filiformibus et culmum excedentibus; panicula foliata castaneo-brunnea tenue, ramis ramulisque fastigiatis; bracteis stricte amplexicaulibus aristatis; spiculis unifloris lineari-lanceolatis geminis vel fasciculis pauci-spiculatis a bractea circumdatis in ramulis paniculæ ultimis tenuiter cylindricis ordinatis; glumis 4, duabus inferioribus membranaceis circum florem involutis, inferiore elliptica acuta breviter aristata in dorso supra medium carinata, carina et arista scabridis, glumis 2 superioribus hyalinis flore multo brevioribus; staminibus 2; stylo alte trifido interdum bifido; achenio . . .

A tall rush-like plant 1·6 m. high, culm 8 mm. thick at the base, the long linear rolled-up leaves generally split and broken at the top, the upper ones drawn out into a long thread-like apex. Panicle young, about 4 dm. long, about 4 cm. broad, the slender fastigiate branches interspersed with the long leaf-like slender bracts of the main rhachis which are filiform above; bracts on branches and branchlets chestnut-brown like the spikelets, forming a closed tubular sheath below and prolonged at the acute apex to an awn. Spikelet barely 5 mm. long, the outermost glume equal to it in length, the second enveloping glume slightly shorter and unawned; two upper glumes short, the lower 1·5 mm. long, the upper slightly shorter; anthers yellow with a conical point barely 2 mm. long, filaments ultimately elongating beyond the glumes.

Hab. Nadarivatu, 2700, dry open hillsides. Fl. Sept. 613. Seemann, 673.

Mr. C. B. Clarke, who saw Seemann's specimen in the Kew Herbarium, suggested its affinity with *G. javanica* but rejected the specimen as too young for naming. It seems however to be quite a distinct species, characterized by the thin panicle with very slender branches and the few (4) glumes below each flower. It resembles *G. javanica* in having a diandrous flower.

CAREX GRAEFFEANA, *Boeck. in Flora*, lviii. (1875) 123.

Mt. Victoria, 4000, near the summit, moss forest. Fl. Sept. 796.

Distrib. Fiji (Viti Levu, Ovalau). Samoa.

This plant was collected by Graeffe (Herb. Kew.) in Ovalau in 1862. It has not since been recorded for Fiji, nor is it given by Drake del Castello for Polynesia, though Whitmee (Herb. Kew.) subsequently found it in Samoa.

CAREX DIETRICHIÆ, *Boeck. in Flora*, lviii. (1875) 122.

Nadarivatu, 2700, in forest. Fl. Sept. 612.

Distrib. Fiji (Ovalau, Ngau), New Caledonia, N.E. Australia. Solomon Islands.

The above species was collected by Milne (H.M.S. 'Herald') in 1854 (Herb. Kew.), but has not been recorded since.

CAREX GIBBSIÆ, *Rendle*, sp. nov.

Herba e rhizomate perennis tripedalis, caule trigono tenue glabro simplici basi foliato, foliis caulinis spicas fasciculatas subtendentibus; foliis basalibus e vagina brevi læte brunnea elongatis linearibus inferne complicatis superne in apicem filiformem attenuatis rigidulis glabris, margine minute serrulatis, caulinis similibus e vagina inaperta tubulosa planis; spicis androgynis ad caulis nodos numerosis fasciculatis in pedicellis elongatis filiformibus e bracteæ foliaceæ vagina exsertis, parte superiore mascula anguste cylindrica, bracteis castaneo-brunneis lanceolatis breviter aristatis, parte inferiore fœminea tenue laxa, bracteis membranaceis obovatis dorso supra medium et arista brevi scabridula, quam flores breviter pedicellati duplo brevioribus; utriculo trigono, angulis leviter scabridulis, longe rostrato, apice bicuspidato; stylo terminali basin versus incrassato superne trifido; caryopsi immatura trigono-ellipsoidea, brunnea.

Culm including inflorescence nearly 1 metre high, barely 2 mm. in diameter, with about 7 nodes above the basal leaves at each of which a cauline leaf subtends a cluster of spikes. Basal leaves nearly 6·5 cm. in length, 6 mm. broad below, sheaths about 4 cm. long, brown with colourless papery margins which ultimately become torn; cauline leaves shorter, sheath of lowest 6·5 cm. long. Internodes above the third cauline node becoming rapidly shortened, the upper part of the culm forming a leafy drooping inflorescence with dense clusters of spikelets at each node, spikes at lower nodes with very long filiform pedicels, as much as 15 cm. long, becoming much shorter in the upper part of the culm. Spikes, exclusive of stalk, generally 2·5–3·5 cm. long, the upper staminate part generally less than one-third the whole length; pistillate flowers about twelve, bract 3·5 mm. long, utricle including the short pedicel a little over 6 mm. long.

Hab. In moss forest near summit ridge of Mt. Victoria, at about 4000. Fl. Sept. 795.

A well-marked species near the Indian *C. longipes*, Don, but a larger plant, differing in the very numerous spikes associated with each stem-node and the larger pistillate flowers.

GRAMINEÆ. (Dr. A. B. Rendle.)

PASPALUM FILIFORME, *Sw. Prod. Veg. Ind. Occ.* 22.

Nadarivatu, 2700, land under cultivation. Fl. Sept. 867.

Distrib. Tahiti, Hawaii, Easter Island.

Originally from N. America, this grass has now spread through tropical and subtropical regions. It is a recent introduction for Fiji.

ISACHNE VITIENSIS, *Rendle*, sp. nov.

Gramen perenne, arundinaceum, altum caulibus ramosis aggregatis multinodis ad apicem foliatis; foliis rigidulis glauco-viridibus anguste lineari-lanceolatis acuminatis scabridulis vaginas pilosulas sæpius excedentibus, ligula breviter ciliata; panicula erecta rigidula pubescente, ramis primo ascendentibus demum subpatentibus ramulos per longitudinem totam gerentibus; spiculis ovoideis breviter pedicellatis; glumis sterilibus æqualibus (1·3 mm. longis) glabris vel superne sparse pilosulis rotundo-ovatis obtusis, inferiore 7-nervi, superiore 5-nervi; glumis florentibus coriaceis pilosis plano-convexis obtusis glumas steriles excedentibus, inferiore ovata 5-nervi florem masculum fovente, superiore elliptica florem fertilem fovente.

A tall grass about 1 metre high with well-marked nodes and purplish internodes, the latter reaching 2 mm. in thickness and covered by the sheaths for about half their length in the lower part of the culms. Leaves to 13 cm. long by 1·3 cm. broad, sheaths to 5·5 cm. long. Panicle ultimately exserted, 15 cm. long by 7 cm. broad; lower branches 5 cm. long, the upper gradually shorter. Spikelets about 1·6 mm. long, pedicel 0·5 to 1 mm. long. Lower flowering glume 1·5 mm. long, anthers of male flowers brown; fertile glume 1·3 mm. long.

Hab. Col i Nadarivatu, about 3100. Fl. Sept. 815.

A well marked species near *I. distichophylla*, Munro (Sandwich Islands), but distinguished by the absence of a callous margin to the leaf and also by the pubescent inflorescence and spikelets. *I. pallens*, Hillebrand, from Oahu, has pubescent florets, but is a much smaller, slenderer plant with glabrous panicle and longer-pedicelled spikelets.

PANICUM COLONUM, *Linn. Syst.* ed. x. 870.

Nadarivatu, 1500, in boggy area off road to Waikubakuba. Fl. & Fr. Sept. 694.

Distrib. Hawaii. Tropics of both hemispheres. Not previously recorded for Fiji.

CENTOTHECA LAPPACEA, *Desv. in Nouv. Bull. Soc. Philom.* ii. (1810) 189.

Nadarivatu, 2700, carpeting in forest. Fl. Sept. 614.

Distrib. Fiji, Samoa, Tonga, Tahiti, Marquesas, N.E. Australia. Tropics of Old World generally.

CONIFERÆ.

TAXACEÆ.

PODOCARPUS IMBRICATA, *Blume, Enum. Pl. Jav.* 89.

Nadarivatu, 2700, in mixed forest. Veg. Sept. Young plant 775 α; forest tree 775 β.

Distrib. Fiji (Viti Levu).

Forest tree, 36 m. high, with straight trunk, and erect branches forming a compact crown.

PODOCARPUS VITIENSIS, *Seem. Bonplandia*, x. (1862) 366.

Nadarivatu, 2780, in mixed forest. ♂ ♀. Sept. 674.

Distrib. Fiji (Viti Levu, Ovalau).

A magnificent tree, known by the natives as the Dakua Salu Salu, it is esteemed the finest wood in the Islands. Of two trees cut down at the same time, one was ♂ and the other ♀. On the ♂ the cones were very sparsely borne, as they only occur singly, generally terminating lateral branches, but their position is sometimes lateral. In the case of the ♀ tree, the young fruit of a beautiful magenta-red, with a waxy bloom, was so abundant as to colour the whole of the crown. Only the mature seeds of this species have been collected before.

Pilger, in his monograph of the Taxaceæ, places *P. vitiensis*, on the strength of the opposite leaves, into section *Nageia*. He, however, admits that the position of the ♂ cone does not agree. It will be seen, however, that the position of the ♀ flowers on short axillary branches leaves no doubt as to its place in *Stachycarpus*, with which the ♂ cones agree. In appearance and habit this species approximates to the New Zealand *P. ferrugineus*, especially in the dorsiventral position and glossiness of the leaves. The ♂ and ♀ organs are also almost identical in position in both species, the former agreeing in number and size, while the latter show the same colour (Cheeseman, Manual N. Z. Flora). That the leaves should be so prominently opposite in *P. vitiensis* hardly bears on the case, as in a series a slight deviation is shown, which can be also traced in *P. Wallichianus*, Presl, and others of the *Nageia* section.

Podocarpus elata, *R. Br. ex Mirb. in Mém. Mus. Par.* xiii. (1825) 75.

Nadarivatu, 2700–3500, in forest. ♀ flowers and young fruits, Sept. 819.

Distrib. New Caledonia, Queensland and N.S. Wales.

This is the first record of this species in Fiji. A slender erect tree, general in the forest. It is also very characteristic of the mountain ridges, where, reduced in size and of shrubbier growth, it runs from 3–10 metres and was seen fruiting at 3 metres.

Podocarpus neriifolia, *D. Don, in Lamb. Pin.* ed. 1, 21 (1824).

Nadarivatu, 2700, on banks of Sigatoko river. ♂ ♀. Sept. 743.

Distrib. Indo-Malaya ; South China.

PINACEÆ.

Agathis vitiensis, *Drake, Ill. Fl. Ins. Mar. Pacif.* 353.

Nadarivatu, 2700, in forest. ♂ ♀. Sept. 894.

Distrib. Fiji (Viti Levu, Vanua Levu, Ovalau, Kadavu).

FILICES.

HYMENOPHYLLACEÆ.

Trichomanes peltatum, *Baker, in Journ. Linn. Soc., Bot.* ix. (1866) 336.

Nakorovatu, 500, encrusting trunks of trees, in forest, general. Aug. 501.

Distrib. Samoa, Admiralty Islands, New Caledonia, E. trop. Australia ; Formosa and trop. Asia.

This species has not previously been recorded from Fiji.

TRICHOMANES MOTLEYI, *V. d. Bosch in Ned. Kruidk. Arch.* v. II. (1861) 145.

Nadarivatu, 2700, on stones in streams, forest. Sept. 666.

Distrib. New Caledonia, Admiralty Islands, New Guinea, Malaya, Ceylon.

A minute species, encrusting stones. The determination is rather uncertain.

TRICHOMANES HYMENOIDES, *Hedw. Fil. Gen. et Sp.* t. 4. f. 3 (1799).

Nadarivatu, 2700, on trunks of trees and on stones, forest, general. Sept. 634.

Distrib. Polynesia. Tropical America, Asia and Africa.

TRICHOMANES PROLIFERUM, *Blume, Enum.* 224 (1828).

Nadarivatu, 2700, clothing bases of tree trunks, forest, common. Sept. 700.

Distrib. Fiji, Samoa, Philippines; Borneo, Java, Ceylon, and western slopes of the Nilgherries.

TRICHOMANES RIGIDUM, *Sw. Prod.* 137 (1788).

Nadarivatu, 2700, terrestrial in forest. Sept. 683.

Distrib. Polynesia. Tropics of both hemispheres, New Zealand, S. Africa, Fernando Po.

TRICHOMANES MAXIMUM, *Blume, Enum.* 228 (1828).

Nadarivatu, 2700, terrestrial, in forest. Sept. 684.

Distrib. Fiji (Viti Levu, Ovalau), Samoa, New Caledonia, Solomon Islands, Queensland; Malaya.

TRICHOMANES JAVANICUM, *Blume, Enum.* 244 (1828).

Nakorovatu, 500, terrestrial in forest. Aug. 502.

Distrib. Fiji, Samoa, New Zealand, E. trop. Australia; Indo-Malaya, Madagascar.

TRICHOMANES MEIFOLIUM, *Bory, Willd. Sp. Pl.* v. (1810) 509.

Nadarivatu, 3500–4000, summit of Mt. Victoria and other high ridges. Sept. 778.

Distrib. Fiji (Viti Levu), Samoa, New Caledonia, New Guinea; Malaya.

A lovely little fern, with fronds of capillary dark green spreading segments, older fronds being quite reddish. It is only found in Fiji on the highest ridges. In the Kew herbarium specimens, where the altitude is given, it is always considerable, viz., New Guinea 5700, Borneo 3000–6000, Java 5000–6000 ft., which points to an altitudinal limitation.

Hymenophyllum australe, *Willd. Sp. Pl.* v. (1810) 527.

Nadarivatu, 2700, on tree-trunks in forest. Sept. 648.

Distrib. Fiji, New Zealand, Tasmania, New Caledonia, N.E. Australia, Philippines, South China, Malaya, Ceylon to Northern India, Bourbon.

Hymenophyllum multifidum, *Sw. in Schrad. Journ.* 1800, II. (1801) 102.

Nadarivatu, 4000, highest ridge of Mt. Victoria, moss forest, abundant. Sept. 786, 728 bis.

Distrib. Fiji (Viti Levu, Ovalau), Samoa, New Zealand and Campbell Islands, E. trop. Australia, New Guinea, Celebes.

CYATHEACEÆ.

Balantium stramineum, *Diels, in Engl. & Prantl, Nat. Pfl.* T. 1, Abt. 4, 119 (1899).

Summit of Koro Levu ridge, 3000, in dry open country. Sept. 836.

Distrib. Fiji, Samoa, New Hebrides, New Caledonia, British New Guinea, Malaya.

This plant was one of the most constant denizens of dry open hillsides with N.W. exposure. The ridge of Koro Levu rises directly out of the "Talasiga" plains and is very characteristic of them, but Milne's Fijian specimens are labelled "in shady places" and in "Sylvis Montanis."

Dicksonia Brackenridgei, *Mett. in Ann. Sci. Nat.* sér. 4, xv. (1861) 81.

Nadarivatu, 4000, summit of Mt. Victoria, moss forest. Sept. 779.

Distrib. Fiji, Samoa, New Hebrides, New Caledonia; Juan Fernandez.

A very handsome tree-fern, bearing fertile pinnules towards the base of the pinnæ, the whole lamina of which is taken up by the indusium. The amount of spores shed from a fertile pinna is incredible, which makes its apparently restricted distribution difficult to account for. Judging from the labels on herbarium material, it apparently favours a certain altitude, but is not restricted to it.

POLYPODIACEÆ.

Dryopteris Cesatiana, *C. Chr. Ind.* 257 (1905).

Foot of Mt. Victoria, 3000, terrestrial, in forest. Sept. 785.

Distrib. Fiji, New Guinea.

This interesting fern was discovered by Beccari in New Guinea and named by Cesati *Meniscium Beccarianum*. Subsequently Horne established it for Fiji. A large patch attracted my attention owing to so many fronds showing vegetative proliferation down the midribs. This character is not mentioned in the original description or in Hooker's 'Synopsis Filicum.' The fronds of Horne's two excellent specimens at Kew were in both cases gummed on to the sheets on their ventral surfaces, but one specimen being soaked off, the first stages of the proliferation were seen near the midribs on several of the fronds.

HUMATA SESSILIFOLIA, *Mett. Fil. Lips.* 102 (1856).
Nadarivatu, 2700, running up trees in forest, general. Sept. 866.
Distrib. Fiji, Celebes, Moluccas, Java.

ASPLENIUM STENOLOBUM, *C. Chr. Ind.* 133 (1905).
Nadarivatu, 2700, terrestrial in forest. Sept. 621.
Distrib. Fiji (Viti Levu), Pitcairn Island.

This fern was common about Nadarivatu. It is very *Davallia*-like in appearance with its deltoid frond and finely cut segments, and was put in *Davallia* by Hooker as *D. fœniculaceum.* It shows most active vegetative proliferation, the old fronds being bent to the ground by the weight of the young plantlets, which throw out roots while still on the parent frond. This peculiarity is not shown in any of the specimens at Kew, nor is there any reference to it in the original description or subsequent works.

STENOCHLÆNA PALUSTRIS, *Bedd. Ferns Br. Ind. Suppl.* 26 (1876).
Nadarivatu, 2700, general, running up trees in forest. Sept. 774.
Distrib. Fiji, Samoa, Tonga, Queensland, South China to Ceylon, Himalayas, Uganda.

NOTHOLÆNA HIRSUTA, *Desv. in Journ. Bot.* iii. (1813) 93.
Matai Siga, 3700, on volcanic agglomerate. Sept. 698.
Distrib. Polynesia, Asia and Australia.
This species was collected in drought condition.

ADIANTUM HISPIDULUM, *Sw. in Schrad. Journ.* 1800, II. (1801) 82.
Nadarivatu, 2700, source of Sigatoko river. Sept. 776.
Distrib. Polynesia, New Zealand, E. Australia, Malaya, E. Africa and adjacent islands.

MONOGRAMMA PARADOXA, *Bedd. Ferns Brit. Ind. Suppl.* 24 (1876).
Vatavula, 1000, on trees in forest. Aug. 522.
Distrib. Fiji (Viti Levu, Ovalau), Samoa, Rarotonga ; E. trop. Australia, Solomon Islands, Philippines, S. China, Malaya to Ceylon.

HYMENOLEPIS SPICATA, *Presl, Epim.* 159 (1849).
Nadarivatu, 2700, on trees in forest. Sept. 747.
Distrib. Polynesia, E. Australia, Asia, Mascarenes.

Polypodium Hookeri, *Brack. in Bot. U.S. Expl. Exp.* xvi. 4 (1854).

Summit of Mt. Victoria, 4000, on trees in moss forest. Sept. 793.

Distrib. Fiji (Viti Levu, Ovalau), Samoa, Rarotonga, Hawaii, E. Australia and Lord Howe's Island.

This species was collected by Seemann on Ovalau at 2000 ft., by Cheeseman at 1800 ft. in Rarotonga, and several other high elevations are given on specimen-labels in the Kew Herbarium.

Polypodium linguæforme, *Mett. in Ann. Lugd.-Bat.* ii. (1866) 228.

Nadarivatu, 2700, running up trunks of trees, forest. Sept. 672.

Distrib. Fiji (Viti Levu), Treasury Island, Solomon Islands, Philippines, New Guinea, Borneo, Sumatra.

This plant is very interesting, being one of the few polypodiaceous ferns in which the fronds are modified for the retention of moisture. In this case the basal portion of the frond is dilated and in that portion a dense cushion of hairy roots aggregates, very like the scattered bunches on the rhizome of *P. accedens,* Bl. These leaf-bases also collect humus as a secondary function. The rhizome, on the young plant collected, ran vertically up a tree-trunk, the fronds occurring at regular intervals on it, the whole frond being adpressed to the trunk.

Looking through the specimens at the Kew Herbarium and at the British Museum, in most cases, the fronds in drying had become displaced, so that the cushion of roots, always present, did not appear to be in strict correlation with them, or a frond would be pulled singly from the rhizome. In no case did I find a collector's note on this interesting biological point, nor is there any mention of it in the original description or subsequent literature.

Polypodium Loxogramme, *Mett. Pol.* 112, n. 216, t. 3. f. 25 (1827).

Nadarivatu, 2700, on trees in forest, pendent. Sept. 712.

Distrib. North and South Pacific Islands ; Japan, S. China, tropical Asia, Africa and adjacent islands.

SCHIZÆACEÆ.

Gleichenia linearis, *C. B. Clarke, in Trans. Linn. Soc.* ser. 2, *Bot.* i. (1880) 428.

Koro Levu ridge, 2500, open reed country. Sept. 837.

Distrib. Fiji, Samoa, Tahiti, Hawaii, Marquesas, New Zealand. Tropics and sub-tropics generally.

Schizæa dichotoma, *Sm. in Mém. Ac. Turin,* v. (1793) 422, t. 9. f. 9.

Nadarivatu, 2700, common everywhere in forest. Sept. 685.

Distrib. Fiji, Tahiti, Tonga. Tropics of both hemispheres.

Lygodium reticulatum, *Schkuhr, Krypt. Gew.* t. 139 (1809).

Nadarivatu, 2700, running up the highest trees, forest. Sept. 839.

Distrib. Fiji, Samoa, Tahiti, E. Australia, New Caledonia, New Hebrides, Isle of Pines.

All plants show variation in the shape of the pinnæ.

MARATTIACEÆ.

Angiopteris evecta, *Hoffm. in Comm. Soc. Reg. Gott.* xii. (1796) 29, t. 5.

Nadarivatu, 2700, in forest. Oct. 887.

Distrib. Fiji, Samoa, Tahiti, Tonga, Solomon Islands, Philippines, Queensand, Pitcairn Island, N. Caledonia. Japan, S. China, Indo-Malaya. Mascarenes.

OPHIOGLOSSACEÆ.

Botrychium daucifolium, *Wall. in Hook. et Grev. Ic. Fil.* t. 161 (1829).

Nadarivatu, 2800, on ground, in forest. Sept. 721.

Distrib. Samoa, Tahiti, Hawaii, S. China and Japan, Java. Ceylon, Northern India and Burma.

Only one specimen was seen of this plant, which is a new record for Fiji.

LYCOPODIACEÆ.

Lycopodium serratum, *Thunb. Fl. Jap.* 341, t. 38.

Matai Siga, on the ridge of, 3300, terrestrial, forest. Sept. 697.

Distrib. Fiji, Samoa, Hawaii, China, Japan, Indo-Malaya. Mexico.

Lycopodium phlegmaroides, *Gaud. Bot. Freyc. Voy.* t. 23.

Nakorovatu, 500, on trees, forest. Aug. 506.

Distrib. Fiji (Viti Levu, Ovalau), Solomon Islands, New Guinea, N. Borneo.

Lycopodium squarrosum, *Forst. f. Prodr.* no. 479.

Nadarivatu, 2700, on rocks and trees in forest. Sept. 649.

Distrib. Fiji, Samoa and Tahiti, Philippines, New Caledonia, New Hebrides, New Guinea, Malaya, Ceylon, E. Himalayas. Mascarene Islands and Bourbon.

Lycopodium Phlegmaria, *Linn. Sp. Pl.* ed. 2, 1564 (1763).

Nadarivatu, 2700, on trees in forest. Sept. 741.

Distrib. Tropics of the Old World, to Queensland and New Zealand.

Lycopodium clavatum, *Linn. Sp. Pl.* ed. 2, 1564 (1763).

Nadarivatu, 2700–3000, dry open hillsides, common. Sept. 680.

Distrib. Arctic, antarctic, and alpine zones of both hemispheres. Mountains of tropical Asia, Africa, and America.

This plant has not previously been recorded for Fiji, though collected in Samoa (*Whitmee*, Herb. Kew.), Hawaii, the Philippines, and New Guinea.

PSILOTACEÆ.

Psilotum triquetrum, *Sw. Syn. Fil.* 117.

Nakorovatu, 500, on trees in forest. Aug. 508.
Distrib. Tropics of Old and New Worlds to New Zealand.

SELAGINELLACEÆ.

Selaginella Menziesii, *Spring, Mon.* ii. 185.

Vatavula, 1000, in forest. Aug. 540.

The above plant is the *S. Menziesii* of Seemann's 'Flora Vitiensis.' It was also collected by Horne in Fiji and named by him *S. flabellata*, Spreng, but it is not the *Lycopodium Menziesii* of Hooker and Greville, which has been transferred to *Selaginella* by Spring, of which the type is Menzies 124, from Hawaii, in the Kew Herbarium.

The above is a very typical Fijian species, common on dry forest-clad ridges, always erect in habit, with a deltoid dark green frond, from 2–50 dm. in height.

Selaginella gracilis, *T. Moore, in Gard. Chron.* n. s. xxv. (1886) 752.

Nadarivatu, 2700, in forest or damp open spaces. Sept. 665.
Distrib. Fiji, South Sea Islands, Philippines.

A very graceful species, with erect light green fronds from 2–3 dm. to 1·50 m. in height. It grows in clumps, often hanging over damp banks, common up to 3000 ft.

Selaginella viridangula, *Spring, in Plant. Herb. Vanheurck.* i. 29.
Nadarivatu, 2700, forest, general. Sept. 654.
Distrib. Fiji (Viti Levu, Ovalau).

MUSCI. (Mr. A. Gepp.)

LEUCOBRYACEÆ.

Leucobryum laminatum, *Mitt. in Bonplandia*, ix. (1861) 366.

Nadarivatu, 2700, tree-trunks, dead wood and on ground, forest. Sept. 772.
Distrib. Fiji.

CALYMPERACEÆ.

Syrrhopodon mammillatus, *C. Muell. in Journ. Mus. Godeff.* Heft vi. (1874) 66.

Nadarivatu, near Nadala, 2300, on dead wood in forest. Sept. 760.
Distrib. Fiji (Ovalau).

ORTHOTRICHACEÆ.

Macromitrium tongense, *Sulliv. in Bot. U.S. Expl. Exp.* vii. t. 5 (1859).

Nadarivatu, 2700, on trunks of trees and dead wood in forest. Sept. 857.
Distrib. Tonga, Isle of Pines and Lord Howe's Island.

Macromitrium incurvifolium, *Schwægr. Hedwig, Sp. Musc. Suppl.* ii. 11. 144. (Orthotrichium incurvifolium, *Hook. et Grev. in Brewster's Edin. Journ.* i. (1824) 117, t. 4.)

Nadarivatu, 2700, tree-trunks in forest. Sept. 755.
Distrib. Tahiti, Pitcairn's Island, New Zealand (Dusky Bay), S. Australia (St. George's Sound), Ternate (Moluccas).

BARTRAMIACEÆ.

Philonotis asperifolia, *Mitt. in Journ. Linn. Soc., Bot.* x. (1869) 185. (Bartramia asperifolia, *Mitt.*)

Mt. Victoria, 3000, cæspitose habit, covering rocks. Sept. 789.
Distrib. Fiji, Samoa.

BUXBAUMIACEÆ.

Diphyscium submarginatum, *Mitt. in Seem. Fl. Vit.* 403.

Summit of Mt. Victoria, 4000, covering stones, moss forest. Sept. 799.
Distrib. Fiji.

BRYACEÆ.

Rhodobryum Graeffeanum, *Paris, Index*, ed. 1, 1116 (1898). (Bryum Graeffeanum, *C. Muell. in Journ. Mus. Godeff.* Heft vi. (1874) 63.)

Foot of Mt. Victoria, 2500, covering rocks in stream. Sept. 798.
Distrib. Fiji.

MNIACEÆ.

Rhizogonium spiniforme, *Bruch, in Flora*, xxix. (1846) 134.

Nadarivatu, near Nadala, 2300, dead wood in forest. Sept. 714. Nadarivatu, 2700, soft patches on trees. Sept. 856.
Distrib. Tropics.

POLYTRICHACEÆ.

Pogonatum Graeffeanum, *Jaeg. Gen. et Sp. Musc.* i. (1875) 716. (Polytrichum (Catharinella) Graeffeanum, *C. Muell. in Journ. Mus. Godeff.* Heft vi. (1874) 61.)

Nadarivatu, 2700, clay-bank by roadside. ♂ ♀. Oct. 858.
Distrib. Fiji, Samoa.

HYPOPTERYGIACEÆ.

HYPOPTERYGIUM OCEANICUM, *Mitt. in Hook. f. Handb. N. Zeal. Fl.* 487 (1867).

Nadarivatu, near Nadala, 2300, dead wood in forest and on stones. Sept. 719.

Distrib. Kermadec Islands, Norfolk Island.

RACOPILUM CONVOLUTACEUM, *C. Muell. in Journ. Mus. Godeff.* Heft vi. (1874) 80. (Hypopterygium convolutaceum, *C. Muell. Synops. Musc.* ii. (1851) 13.)

Nadarivatu, 2700, on volcanic red rock in stream, forest. ♀. Sept. 739.

Distrib. Samoa and Norfolk Island. N. S. Wales, Queensland and W. Australia, Tasmania.

NECKERACEÆ.

GAROVAGLIA SETIGERA, *Mitt. in Seem. Fl. Vit.* 396 (1873). (Pilotrichum setigerum, *Sulliv. in Proc. Amer. Acad.* iii. (1852–57) 80.)

Nadarivatu, near Nadala, 2300, tree-stems in forest. ♀. Sept. 756.

Distrib. Fiji, Samoa, Queensland, Victoria.

SPIRIDENS BALFOURIANUS, *Grev. in Ann. & Mag. Nat. Hist.* i. (1848) 326, t. 18.

Col i Nadarivatu, 3200, luxuriant growth on trees, S.E. ridge, ♀ and vegetative shoots. Sept. 602.

Distrib. Fiji, Tahiti, New Caledonia.

Grows out in tufts, at right angles to the stem, forming luxuriant growth on trees in some moss-forest areas.

LESKEACEÆ.

THUIDIUM SAMOANUM, *Mitt. in Journ. Linn. Soc., Bot.* x. (1869) 186.

Mt. Victoria, 3000, on stones. Sept. 802.

Distrib. Fiji, Samoa, Solomon Islands.

HOOKERIACEÆ.

HOOKERIA GRAEFFEANA, *C. Muell. in Journ. Mus. Godeff.* vi. (1874) 77.

Nadarivatu, 2800, dead wood in forest. ♀. Sept. 738.

Distrib. Fiji.

HYPNACEÆ.

THAMNIELLA POROTRICHOIDES, *Besch. in Ann. Sci. Nat.* sér. 5, xviii. (1873) 240.

Nadarivatu, 2800, on stones in stream, in forest. ♂ ♀. Sept. 737.
Distrib. New Caledonia.

CALLICOSTELLA OBLONGIFOLIA, *Jaeg. Gen. et Sp. Musc.* ii. (1877) 256. (Hookeria oblongifolia, *Sulliv. in Proc. Am. Acad.* iii. (1852–7) 80.)

Mt. Victoria, near summit, 3800, on dead wood, moss forest. Sept. 803. Nadarivatu, 2700. 717.
Distrib. Fiji, Samoa, Tahiti, Marquesas.

SEMATOPHYLLUM BREVICUSPIDATUM, *Jaeg. et Sauerb. Gen. et Sp. Musc.* ii. (1878) 447. (Acroporium brevicuspidatum, *Mitt. in Journ. Linn. Soc., Bot.* x. (1869) 183.)

Mt. Victoria, foot of, 2500, on rocks. Sept. 789.
Distrib. Samoa, Hawaii, South Sea Islands.

TRICHOSTELEUM SAMOANUM, *Jaeg. et Sauerb. Gen. et Sp. Musc.* ii. (1878) 479. (Hypnum (Sigmatella) samoanum, *Mitt. in Journ. Linn. Soc., Bot.* x. (1869) 184.)

Mt. Victoria, summit ridge, 4000, on dead wood in moss forest. Sept. 801.
Distrib. Fiji, Samoa.

TRICHOSTELEUM HERPETIUM, *Jaeg. et Sauerb. Gen. et Sp. Musc.* ii. (1878) 480. (Hypnum (Sigmatella) herpetium, *C. Muell. in Journ. Mus. Godeff.* vi. (1874) 84.)

Nadarivatu, 2800, dead wood in forest. Sept. 716.
Distrib. Samoa.

TRICHOSTELEUM PICKERINGII, *Jaeg. et Sauerb. Gen. et Sp. Musc.* ii. (1878) 846. (Hypnum Pickeringii, *Sulliv. in Proc. Am. Acad.* iii. (1852–7) 74. Sematophyllum Pickeringii, *Besch. in Ann. Sci. Nat.* sér. 7, xx. (1874) 49.)

Nadarivatu, near Nadala, dead wood in forest. Sept. 759. Nadarivatu, 3000. 740.
Distrib. Fiji, Samoa, Tahiti, Hawaii, Solomon Islands, New Caledonia.

ISOPTERYGIUM BYSSICAULE, *Jaeg. et Sauerb. Gen. et Sp. Musc.* ii. (1878) 502. (Hypnum (Taxicaulis) byssicaule, *C. Muell. in Journ. Mus. Godeff.* Heft vi. (1874) 89).

Nadarivatu, near Nadala, 2300, dead wood in forest. Sept. 758.
Distrib. Samoa.

Ectropothecium calodictyon, *Jaeg. et Sauerb. Gen. et Sp. Musc.* ii. (1879) 535. (Hypnum (Vesicularia) calodictyon, *C. Muell. in Journ. Mus. Godeff.* Heft vi. (1874) 80.)

Mt. Victoria, near summit, 4000, on dead wood. Sept. 891. Nadarivatu, 2700, dead wood in forest. 892.
Distrib. Samoa.

Ectropothecium pacificum, *Mitt. in Journ. Linn. Soc., Bot.* x. (1869) 180.

Nadarivatu, dead wood in forest. Sept. 715.
Distrib. Fiji, Samoa, New Hebrides and New Caledonia.

Leucomium debile, *Mitt. in Journ. Linn. Soc., Bot.* x. (1869) 181. (Hookeria debilis, *Sulliv. in Proc. Amer. Acad.* iii. (1852–7) 79.)

Nadarivatu, 2800, dead wood in forest. 718.
Distrib. Fiji, Samoa, Tahiti, New Caledonia, Nukalina.

Hypnodendron subspininervium, *Jaeg. et Sauerb. Gen. et Sp. Musc.* ii. (1879) 623. (Hypnum subspininervium, *C. Muell. in Bot. Zeit.* xv. (1857) 782.)

Nadarivatu, 2800, rotten wood in forest. 708.
Distrib. Fiji, Samoa, Hawaii, New Hebrides, Malay Archipelago, and Ceylon.

HEPATICÆ. (Mr. A. Gepp.)

MARCHANTIACEÆ.

Marchantia vitiensis, *Steph. in Bull. Herb. Boiss.* vii. (1899) 520.

Nakorovatu, 100, on wet banks in shade, general. ♂ ♀. Aug. 503.
Distrib. Fiji.

Dumortiera trichocephala, *Nees, Synops. Hepat.* 545 (1846).

Spur of Mt. Victoria, damp bank in forest, 3300, general. Aug. 525.
Distrib. Samoa, Hawaii, Java.

Dumortiera velutina, *Schiffn. Hepat. Fl. Buitenzorg,* 26 (1900).

Nakorovatu, 200, on bank by stream, on red clay. Fr. Aug. 500. Nadarivatu, 2700, bank of stream in forest. Sept. 646.
Distrib. Java and Sumatra.

JUNGERMANIACEÆ ANAKROGYNÆ.

Aneura tenuicostata, *Steph. in Bull. Herb. Boiss.* vii. (1899) 735. (Riccardia tenuicostata, *Schiffn. in Denksch. k. Akad. Wien,* lxvii. (1898) 116.)

Vatavula, 300, on dead wood in shade. Fr. Aug. 518, 519 bis.
Distrib. Singapore, Java.

Aneura Nadeaudii, *Steph. in Bull. Herb. Boiss.* vii. (1899) 750.

Spur of Mt. Victoria, 3000, mossy bank in forest. ♂ ♀. Aug. 527, 528 bis. Mt. Victoria, 3500, on dead wood in forest. 791.

Distrib. Tahiti.

Aneura maxima, *Steph. in Bull. Herb. Boiss.* vii. (1899) 760. (Riccardia maxima, *Schiffn. in Denkschr. k. Akad. Wien*, lxvii. (1898) 177.)

Vatavula, 300, on shaded bank of red clay. ♂ ♀. Aug. 505, 517. Nadarivatu, 2700, on dead wood and amongst moss in forest. Sept. 628, 632, 647. Mt. Victoria, 3000, dead wood. 790.

Distrib. Java, Sumatra.

Aneura lobata, *Steph. in Bull. Herb. Boiss.* vii. (1899) 761. (Riccardia lobata, *Schiffn. in Denkschr. k. Akad. Wien*, lxvii. (1898) 178.)

Nadarivatu, 3000, in forest. Fr. Sept. 636.

Distrib. Java, Sumatra, New Caledonia.

Aneura flagellaris, *Gepp*, sp. nov.

Dioica. Frons late linearis, crassiuscula (0·4 mm.), viridis, expansa, 5 cm. longa, furcata, radicellis numerosis arcte repens, furcis approximatis, imbricatis, 3–4 mm. latis; costa lata, 10 cellulas crassa, sensim usque ad margines attenuata; marginibus lobatis, haud alatis; lobis 3–4 ramulos adscendentes elongatos (7 mm.) angustatos (0·5–0·2 mm. crassos) simplices vel furcatos filiformes sursum attenuatos apice capitellatos papillosos sæpe proferentibus. Frondis cellulæ interiores 50–70 μ, corticales 25–30 μ in sectione transversa.

Hab. Vatavula, 300, creeping on trees in forest. Sept. 515.

Metzgeria furcata, *Nees, Europ. Lebermoose*, iii. (1838) 485.

Nadarivatu, 2700, on trunks of trees in forest. ♀. Aug. 569.

On spur of Mt. Victoria, between Yasoqo and Navai, 3000, on *Alsophila*-stems in forest. Aug. 526.

Distrib. Europe, Africa, Australasia, and Chile.

Symphyogyna vitiensis, *Jack & Steph. in Bot. Centralbl.* lix. (1894) 108.

Nadarivatu, Nadala, 2300, on red volcanic clay in forest. ♀. Sept. 720.

Distrib. Fiji.

Treubia bracteata, *Steph. in Engl. Bot. Jahrb.* xxiii. (1897) 302.

Nadarivatu, 2700–3300, on red clay and on moss in forest. ♀. Sept. 627.

Distrib. Samoa.

JUNGERMANIACEÆ AKROGYNÆ.

Plagiochila Powellii, *Mitt. ex Steph. in Bull. Herb. Boiss.* sér. 2, iii. (1903) 884.

Top of Col i Nadarivatu, 3500, epiphytic in forest. Sept. 623.

Distrib. Samoa.

Lophocolea muricata, *Nees, Synops. Hepat.* 169 (1845).

Nadarivatu, 2300, on dead wood in forest. Sept. 570 p. p.

Distrib. Australia, New Zealand, New Guinea, Java, and India; Bourbon, Mozambique, Cape of Good Hope. Chile, Brazil, and Cuba.

Chiloscyphus parvulus, *Schiffn. Hepat. Fl. Buitenzorg,* 206 (1900).

Nadarivatu, 2300, on dead wood in forest. Sept. 570 p. p.

Distrib. Java.

Chiloscyphus argutus, *Nees, Synops. Hepat.* 183 (1845).

Mt. Victoria, 3500, on dead wood in forest. Sept. 791 p. p.

Distrib. Pacific Islands, Australia, Malay Archipelago. Japan.

Mastigobryum combinatum, *Jack et Steph. in Bot. Centralbl.* lx. (1894) 102.

Top of Col i Nadarivatu, 3500, in forest. Sept. 625.

Distrib. Samoa.

Mastigobryum sp.

On spur of Mt. Victoria, between Yasoqo and Navai, 3000. Aug. 528 p. p.

Lepidozia Lindenbergii, *Gottsche, Synops. Hepat.* 213 (1845).

Nadarivatu, 2300, on dead wood in forest. Sept. 895.

Distrib. New Zealand, Tasmania, Australia.

Trichocolea Pluma, *Mont. in Bot. Voy. Bonite,* 238 (1846).

On spur Mt. Victoria, between Yasoqo and Navai, 3300. Aug. 530.

Distrib. Malay Archipelago.

On *Alsophila*-stems in forest, forming pendent masses.

Schistocheila heterodonta, *Colenso, in Trans. N. Zealand Inst.* xxi. (1888) 55.

On Mt. Victoria, 3000, in forest. Sept. 896.

Distrib. New Zealand.

Pleurozia gigantea, *S. O. Lindb. in Lindb. et Lackstr. Schedæ ad Hep. Scand. exs.* fasc. i. no. 5 (1874).

Summit of Mt. Victoria, 4000, hanging in tufts from trunks of trees. Sept. 792.

Distrib. Hawaii, Malay Archipelago, Burma, Ceylon. Africa.

Ptychanthus striatus, *Nees, in Synops. Hepat.* 289 (1844).

Top of Col i Nadarivatu, forest. Sept. 624.

Distrib. Malay Archipelago. India. Africa.

ANTHOCEROTACEÆ.

Anthoceros flagellaris, *Mitt. in Seem. Fl. Vit.* 419 (1873).

Nadarivatu, 3000, on bank in forest. Aug. 655.

Distrib. Samoa.

Anthoceros sp.

Nakorovatu. Aug. 504. Yasoqo, 1500, on banks in forest. Aug. 529. Mt. Victoria, 3500, on dead wood in forest. Sept. 791.

Dendroceros javanicus, *Nees, Synops. Hepat.* 582 (1846).

Nadarivatu, 2700, on trunks of trees and dead wood in forest, general. Veg. Oct. 897.

Distrib. Tahiti. Java.

Conspicuous from its much crisped, yellow-green thallus, spreading thread-like on trunks of trees.

FUNGI. (Miss A. Lorrain Smith.)

XYLARIACEÆ.

Xylaria cubensis, *Sacc. Syll. Fungi,* i. (1882) 314.

Nadarivatu, 2700, on dead wood in forest. Oct. 806.

Distrib. Ceylon, Cuba, West Indies, and Mexico.

Xylaria polymorpha, *Grev. Fl. Edin.* 355 (1824).

Nadarivatu, 2700, on dead wood in forest. Oct. 849.

Distrib. Universal.

UREDINACEÆ.

Æcidium Balansæ, *Cornu, in Pat. Cham. Nouv. Calédonie,* 6, n. 84 (1887).

Nadarivatu, 2700, on *Agathis vitiensis.* Aug. 566.

Distrib. New Caledonia.

This *Æcidium* was very common on the Dakuas about Nadarivatu, young plants and old trees being equally affected, and almost every leaf attacked. On one huge tree, in this condition, that I saw cut down, there were only eight ♀ cones altogether and no young ones, which suggests that this disease may affect the vitality of the species. It was described by Cornu on *Agathis ovata*, Warb.

AURICULARIACEÆ.

HIRNEOLA AURICULA-JUDÆ, *Berk. Outl.* 289 (1860).
Nadarivatu, 2700, on dead wood in forest. Oct. 854.
Distrib. World-wide.

THELEPHORACEÆ.

STEREUM LOBATUM, *Fr. Epic.* 547 (1838).
Nadarivatu, 2700, on dead wood in forest. Sept. 675.
Distrib. Tropics of both hemispheres. Samoa, N. Zealand, and Tasmania.

STEREUM ELEGANS, *G. F. W. Mey. Essiq.* 305 (1818).
Nadarivatu, 2700, on dead wood in forest Sept. 848.
Distrib. Samoa, Australia, Tasmania, New Zealand, S. America, and S. Africa.

STEREUM VELLEREUM, *Berk. in Hook. Fl. N. Zealand*, ii. (1855) 183.
Nadarivatu, 2700, on dead wood in forest. Sept. 820.
Distrib. Australia and New Zealand.

THELEPHORA PALMATA, *Fr. Syst. Myc.* i. 432 (1821).
Nadarivatu, 2700, on dead wood in forest. Oct. 824.
Distrib. Europe and America.

HYMENOCHÆTE CROCICREAS, *Berk. & Broome, in Journ. Linn. Soc., Bot.* xiv. (1875) 68.
Nadarivatu, 2700, forming large areas on living trees in forest. Sept. 831.
Distrib. Ceylon.

CLAVARIACEÆ.

LACHNOCLADIUM FURCELLATUM, *Lév. in Ann. Sci. Nat.* sér. 3, v. (1846) 159.
Nadarivatu, 2700, on dead wood in forest. Sept. 888.
Distrib. Tropics of S. America, Asia, and Australia.

HYDNACEÆ.

HYDNUM OCHRACEUM, *Pers. Syn.* 559 (1801).
Nadarivatu, 2700, on dead wood in forest. Oct. 852.
Distrib. Ceylon, Australia, Central America, Europe.

POLYPORACEÆ.

Fomes australis, *Cooke, in Grevillea*, xiv. (1885) 18.
Nadarivatu, 2700, on trees in forest. Sept. 822.
Distrib. Universal.

Fomes rhabarbarinus, *Sacc. Syll.* vi. (1888) 164.
Nadarivatu, 2700, dead wood in forest. Sept. 823.
Distrib. Brazil.

Polyporus sulphureus, *Fr. Syst. Myc.* i. (1821) 357.
Nadarivatu, 2700, on dead wood in forest. Sept. 859.
Distrib. World-wide.
This fungus is appreciated by the Fijans, who eat it both raw and cooked.

Polystictus cichoriaceus, *Fr. N. Symb.* 92 (1851).
Nadarivatu, 2700, on dead wood in forest. Sept. 821.
Distrib. Australia, Philippines, Malacca, Ceylon.

Polystictus peradenyæ, *Berk. & Broome, in Journ. Linn. Soc., Bot.* xiv. (1875) 51.
Nadarivatu, 2700, on dead wood in forest. Sept. 826.
Distrib. S.E. India, Ceylon, Borneo.

Polystictus flabelliformis, *Klotzsch, in Linnæa*, viii. (1833) 483.
Nadarivatu, 2700, on dead wood in forest, common. Sept. 830.
Distrib. Tropical Asia, Australia, and America.

Laschia candida, *A. L. Sm.*, sp. nov. (Fig. 2, p. 212.)

L. pileo reniformi, tenui, pellucido, plano, tremelloideo-gelatinoso, subfavoso-reticulato, lateraliter adnato, circiter 1–1·5 cm. lato; hymenio alveolis inæqualibus in series subradiantes dispositis; basidiis apice 2-sterigmaticis; sporis minutis subglobosis, hyalinis, 4–5 μ diam.; cystidiis asperulis, granulas crystallinas sparsas gerentibus, 30 μ longis, supra insertionem 10 μ latis.

Hab. Nadarivatu, 2700, on dead twigs in forest. Sept. 851.

Laschia crenulata, *A. L. Sm.*, sp. nov. (Fig. 1, p. 212.)

L. pileis confertis reniformibus, cartilagineo-gelatinosis, margine crenulatis, hyalinis, levibus, lateraliter adnatis, circiter 1–1·5 cm. latis; poris in series magis regulares dispositis; basidiis apice 4-sterigmaticis; cystidiis nullis; sporis globosis, hyalinis, 5 μ diam.

Hab. Nadarivatu, 2700, on dead twigs in forest. Sept. 853.

AGARICACEÆ.

Schizophyllum commune, *Fr. Syst. Myc.* i. (1821) 330.
Nadarivatu, 2700, on dead twigs in forest. Sept. 828.
Distrib. World-wide.

Xerotus Berterii, *Mont. in Ann. Sci. Nat.* sér. 2, iii. (1886) 349.
Nadarivatu, 2700, dead twigs in forest. Sept. 827.
Distrib. New Zealand, Ceylon, Central India, West Indies, and Juan Fernandez.

Lentinus Gibbsiæ, *A. L. Sm.*, sp. nov.

L. pileo coriaceo, tenui, rotundato, 0·5 cm. lato, resupinato-excentrice affixo, setulis brevibus brunneis vestito; margine fimbriato; lamellis e puncto excentricos radiantibus, æqualibus, flavo-brunneis, acie obscuriore circiter 0·5–0·6 mm. lato.

Hab. Nadarivatu, 2700, dead twigs in forest. Sept. 889.

LICHENES. (Miss A. Lorrain Smith.)

CŒNOGONIACEÆ.

Cœnogonium Leprieurii, *Nyl. in Ann. Sci. Nat.* sér. 4, xvi. (1862) 89.
Vatavula, Nabacara Hill, 500, on trees in forest. Aug. 516.
Distrib. Oceania and Australia. E. Africa. Tropical America.

COLLEMACEÆ.

Leptogium chloromelum, *Nyl. Syn. Lich.* i. (1860) 128.
Nadarivatu, 2700, on trees in forest. Sept. 833.
Distrib. Oceania. Tropical America. W. Africa.

PANNARIACEÆ.

Pannaria pannosa, *Del. ex Nyl. Syn.* ii. (1860) 29.
Nadarivatu, 2700, on trunks of trees in forest. Aug. 571.
Distrib. Tropics everywhere.

STICTACEÆ.

Sticta demutabilis, *Krempelh. in Journ. Mus. Godeff.* i. (4) 98 (1874).
Matani Siga, on the ridge of, 3200, on trees in forest. Sept. 705.
Distrib. Fiji, Samoa, New Guinea, Philippines, and N.E. Australia.

Stictina crocata, *Nyl. Syn. Lich.* i. (1860) 338.
Nadarivatu, 2700, on trees in forest. Sept. 832.

DICHONEMIACEÆ.

Dichonema sericeum, *Mont. in Bél. Voy. Ind. Or., Crypt.* 155, t. 14. f. 1 (1834–38).

Nadarivatu, 2700, on trees in forest. Sept. 855.

Distrib. Tropics and sub-tropics.

A very general species, composed of superposed fan-shaped thalli forming vertical lines on the trunks of trees, resembling *Pavonia*. Grey-green in colour.

CHARACEÆ. (Mr. H. Groves.)

Nitella gracilis, *Ag. Syst. Alg.* 125 (1824).

Near Waikubakuba, on the Tavua road, 500. On soapstone, in stream. Sept. 762.

Distrib. Cosmopolitan.

I rather think this is the same plant that Dr. Allen described as *N. Muthuata* from Fiji, but it differs much in appearance from his drawing—I have not seen a specimen—and breaks down his specific characters.

ALGÆ. (Mr. W. West.)

CHLOROPHYCEÆ.

Œdogonium sp.

Base of Koro Levu, 500, in stream. Sept. 763.

Sterile, cells 24–404 μ broad, 4 to 5 times longer than broad.

Œdogonium sp.

Nadarivatu, Sigatoko river, 2700, free floating. Sept. 845.

Cells 6·5–8·5 μ broad, 10 to 12 times longer than broad; no mature oospores.

Rhizoclonium hieroglyphicum, *Kütz. em. Stockm.*

Nadarivatu, source of Sigatoko, 2700. Sept. 775.

Distrib. Samoa. Central and S. Europe. N. & S. America.

Spirogyra sp.

Nadarivatu, Sigatoko river, 2700, free floating. Sept. 845 p. p.

Sterile, cells 10–12 μ broad, 10 to 12 times longer than broad; chromatophores two.

Closterium sp.

Base of Koro Levu, 500, in stream. Sept. 763 p. p.

Had been dried; probably *C. Ehrenbergii*, Meneg.

COSMARIUM PUNCTULATUM, *Bréb.*

Nadarivatu, source of Sigatoko, 2700. Sept. 775 p. p.
Distrib. Europe, Siberia, Burma, Japan. N. Zealand. N. America and S. Africa.

PEDIASTRUM TETRAS, *Ralfs.* Forma.

Base of Koro Levu, 500, in stream. Sept. 763 p. p.
Distrib. Collected by Reinecke in Samoa. Widely distributed.

BACILLARIACEÆ.

SYNEDRA ULNA, *Ehrenb.*

Nadarivatu, Sigatoko river, 2700. Sept. 775, 845 p. p.
Distrib. Europe and America.

EUNOTIA LUNARIS, *Grun.*

Nadarivatu, Sigatoko river, 2700, free floating. Sept. 845 p. p.
Distrib. Europe.

EPITHEMIA ARGUS, *Kütz.*

Base of Koro Levu, 500, in stream. Sept. 763 p. p.
Distrib. Europe.

EPITHEMIA GIBBA, *Kütz.*

Nadarivatu, Sigatoko river, 2700, free floating. Sept. 845 p. p.
Distrib. Europe and America.

EPITHEMIA GIBBERULA, *Kütz.*

Base of Koro Levu, 500, in stream. Sept. 763 p. p.
Distrib. Europe and America.

DENTICULA TENUIS, *Kütz.*

Nadarivatu, source of Sigatoko, 2700. Sept. 775 p. p.
Distrib. Europe.

SURIRELLA OVALIS, *Bréb.*

Nadarivatu, Sigatoko river, 2700. Sept. 775, 785 p. p.
Distrib. Europe.

CYMATOPLEURA ELLIPTICA, *W. Sm.* Var. CONSTRICTA, *Grun.*

Nadarivatu, source of Sigatoko, 2700. Sept. 775.
Distrib. Switzerland and Austria.

NAVICULA VIRIDIS, *Kütz.*

Tavua, 50, in hot springs, temp. 59°, common. Oct. 893.
Distrib. Tahiti. Europe and America. Africa.

GOMPHONEMA OLIVACEUM, *Kütz.*

Nadarivatu, Sigatoko river, 2700, free floating. Sept. 845 p. p.
Distrib. Europe and N. Africa.

GOMPHONEMA INTRICATUM, *Kütz.*

Tavua, 50, in hot springs, 59°, common. Oct. 893 p. p.
Distrib. Europe.

NITZSCHIA PALEA, *W. Sm.*

Nadarivatu, Sigatoko river, 2700. Sept. 745.
Distrib. Europe, Japan, Abyssinia.

MYXOPHYCEÆ.

AULOSIRA THERMALIS, *G. S. West.*

Nadarivatu, Sigatoko river, 2700, free floating. Sept. 845.
Distrib. Iceland.

PHORMIDIUM FONTICOLA, *Kütz.*

Nadarivatu, in Sigatoko river, 2700, free floating. Sept. 845 p. p.
Distrib. Europe.

PHORMIDIUM TENUE, *Gom.*

Tavua, 50, in hot springs, 59°, common. Oct.
Distrib. Samoa. Central Asia, Europe, and N. America.

PHORMIDIUM LAMINOSUM, *Gom.*

Tavua, 50, in hot springs, 59°, common. Oct.
Distrib. Australia, Sumatra, N. & Trop. Africa. Europe.

PHORMIDIUM LURIDUM, *Gom.*

Tavua, 50, in hot springs, 59°, common. Oct.
Distrib. Ceylon. Europe. St. Vincent.

OSCILLATORIA GEMINATA, *Gom.*

Base of Koro Levu, 500, in stream. Sept. 763 p. p.
Distrib. Siam, Sumatra. Central Africa, South Europe, and N. America.

In 763 there were cases of the Protozoon, *Centropyxis aculeata*, Stein, a rhizopod.

PLANT ASSOCIATION IN THE VICINITY OF NADARIVATU.

Nadarivatu is situated on the extreme edge of a precipitous escarpment, 2000 feet in height. Immediately behind it, to the south, are the forest-clad ranges of the watershed, which culminate in Mt. Victoria, the highest point in Fiji. To the north-west you look straight down the scarp on to an undulating plain, 2000 feet below, of reed-covered, treeless country, which stretches to the sea, about 15 miles distant by road to Tavua, at the mouth of the Tavua river.

The forest formations about Nadarivatu may be well classified according to Copeland's * arrangement for the same type in the Philippines, viz.:—

The High Forest. Clothing the northern and north-western mountain slopes and ridges, and the valleys on the Nadarivatu side.

The Rain Forest. Characteristic of the south-eastern region and mountain slopes.

The Moss Forest. Of stunted trees, swathed in moss. Limited to the summit-ridge of Mt. Victoria, 4000 feet, and a point on the Nadarivatu ridge at 3600 feet.

High Forest.

Forest-trees.—The Fijian forest, of an average height of 80–100 feet, seen from above, forms one level of dark green foliage, broken at the time of my visit by even washes of red, from the great abundance of the splendid Vuga (*Metrosideros villosa*) which, generally beginning life as an epiphyte, eventually grows into one of the finest forest trees. It is as celebrated in the lore of Fiji as the Rata (*M. robusta*, A. Cunn.) is in New Zealand, and holds the same place in the affection of the inhabitants. The Vuga resolves itself into a sheet of bloom, which the flat capitate crown, so characteristic of tropical trees, accentuates. The flowers are often yellow, when the effect is just as fine.

In contrast to the brilliant Vuga, the dense dark green heads of the Dakuas (*Agathis vitiensis*) are conspicuous from their size and number, lightened by the fern-like shining foliage of that glory of the Fijian Forest, the Dakua Salu Salu (*Podocarpus vitiensis*). None of the allied New Zealand species approach these two trees in beauty of outline. The Kauri (*Agathis australis*, Salisb.) with smaller leaves, lighter green in colour and showing the elongating branches of more temperate latitudes, lacks the monumental effect, so striking in the closely related Dakua, while the Salu Salu in its splendid habit and exquisite symmetry of foliage excels any conifers so far known. The Kau Solo (*Podocarpus imbricata*) with its feathery foliage of light glaucous green and smaller heads, and the delicate *Casuarina nodiflora* can also be picked out from the even mass of vegetation. Of other High Forest trees, not so conspicuous, may be mentioned *Elæocarpus Kambi*, *Eugenia effusa*, *Parasponia Andersonii*, *Gironniera celtidifolia*, *Ficus Harveyi*, *Ficus obliqua*, peculiarly striking from its fine sage-green foliage, spreading crown and white stems and roots, also happy as an epiphyte, *Maoutia australis*, *Rhus simarubæfolia*, and the stinging Salato (*Laportea Harveyi*, Seem.) with its large flaccid leaves. *Podocarpus elata* occurs scattered as a slender tree, and *P. neriifolia* outlines the rivers on both banks, the spreading branches meeting over the surface of the water.

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* Copeland, E. B., "The Comparative Ecology of San Ramon Polypodiaceæ," Philipp. Journ. Sci., Bot. ii. (1907) pp. 1–73.

Undergrowth.—Entering the forest, which in the spring is easy to penetrate in every direction and quite dry, even the streams being low, I was surprised at the great variety of the carpeting undergrowth and its herbaceous character, as most writers emphasize the prevalence of ferns in this connection in tropical forests. There was also none of the mysterious darkness so often dwelt upon, but an even distribution of light, no doubt due to the great height of the trees, with their unbranched trunks and compact crowns. Where not too damp, the charming little *Ophiorrhiza peploides* and the more spreading and flaccid *O. laxa*, the slightly fleshy *Pellionia filicoides*, and *Centotheca lappacea* creeping on the ground, would abound. The long green spikes of *Habenaria tradescantifolia*, varied by the shorter white ones of *Adenostylis stricta*, and the yellow flowers and large calanthe-like leaves of *Chrysoglossum Gibbsiæ* were general. Where the growth was not so thick, the wax-like white flowers and exquisite velvety green leaves of *Odontochilus longiflorus* and the still more striking leaves of *Anæctochilus vitiensis*, with their iridescent metallic sheen, would occur, with the *Davallia*-like *Asplenium stenolobum*, the fronds of which are weighted down by young plantlets bearing roots 4 or 5 cm. long, so abundant is its vegetative proliferation. *Trichomanes rigidum*, *T. maximum*, and *Schizæa dichotoma* were common ferns. Of larger plants, *Elatostema fruticosum* and several Pipers were very abundant.

Piper melanostachyum, aptly named by M. de Candolle, of neat spreading habit, with small leaves, contrasted with the straggling *P. oxycarpum*, a very hairy plant, with ong pendent racemes and red fruit. *P. McGillivrayi* var. *fascicularis* and *P. erectispicum* were quite general. The magnificent *P. polystachyum*, 3 m. in height, with immense roundish leaves and erect tassels of white flowers, favoured damper places by streams, associated with the handsome *Pellionia vitiensis* and *Elatostema elatostemoides*, both always massed, with recurved shoots, simulating huge fronds from the size and dorsiventral position of the leaves, which are thus admirably adapted to the subdued light of the forest. The exquisite *Selaginella gracilis* was also abundant in such situations, growing in erect clumps of single fronds, over a metre high, reflexed at the apex. By the streams, carpeting stones, and on the ground, often large patches of the giant hepatic *Treubia bracteata*, most striking in full fruit, would be seen.

The forest undershrubs were *Schefflera vitiensis*, the deliciously fragrant and abundant *Leucosmia acuminata, Gardenia vitiensis, Psychotria Storckii, Solanum vitiense* and *S. tetrandrum*. The palm-like *Pandanus Joskei*, often attaining a great height, and *Angiopteris evecta* were also very common, and *Alpinia Boia*, about 4 m. high, formed graceful clumps, growing especially near open places.

Scandent Plants.—Monstera deliciosa, Philodendron and *Calamus* sp., *Freycinetia Storckii, F. Milnei, F. Pritchardii*, and the delicate little *F. vitiensis*, with *Stenochlæna palustris, Polypodium linguæforme*, and the stem-clasping ivy-like *Piper insectifugum*, with innumerable pendent white spikes, formed but a tithe of the rampant growth. Of flowering lianes the commonest were *Alyxia scandens* and *A. stellata, Morinda Forsteri*, the rusty-looking *Mæsa corylifolia*, the beautiful and abundant *Clerodendron amicorum*, whose large white flowers are produced in snowy profusion. *Agatea violaris, Jasminum simplicifolium, Rubus paniculatus*, and the dainty *Psychotria sulphurea*, with a profusion of small white flowers, were all of scrambling habit, spreading over the crowns of the trees. *Passiflora vitiensis* and *Smilax vitiensis* were associated tendril plants, with *Geitonoplesium cymosum* and *Lygodium reticulatum* equally abundant, but more twining in habit.

Epiphytes.—Astelia montana is as characteristic of the forks of the monumental Dakua branches as its New Zealand allies on their Kauri hosts. *Procris montana* of spreading habit is striking with its red gelatinous pseudo-fruits, like a double row of berries up the stem, the male plants feathered from the abundant white flowers. Peperomias are very numerous, varying from the spreading, glaucous-green little *P. curtispica* to *P. carnosa*, with erect stems up to a metre in height and large intensely dark green leaves. *Asplenium Nidus, Hymenophyllum australe, Polypodium Loxogramme, Hymenolepis spicata, Trichomanes peltatum, T. hymenoides*, and *T. saxifragoides* were general, and also the mosses *Leucobryum laminatum, Hypopterygium oceanicum, Trichosteleum pacificum*, &c., which grow on the trunks of the trees much as in deciduous woods. Lichens, principally Stictaceæ, form most luxuriant growth, the *Pavonia*-like thalli of the bright green *Cœnogonium Leprieurii* and the grey-green encrusted *Dictyonema sericeum* being conspicuous. In orchids, *Earina laxior*, with its extraordinary ladder-like last year's spikes, was very abundant, forming large clumps in the forks of trees; *Dendrobium Gordoni, D. sertatum*, and *D. prasinum* were the showiest species, while the minute *Phreatia vitiensis* was general. I did not observe the epiphytic gardens described for tropical countries as growing on the upper branches and leaves of the forest trees; all the species enumerated above clothed the trunks and lower branches of the trees in the forest shade.

This high forest runs up to about 3500 feet, the trees thinning out gradually and becoming smaller on the ridges, which, composed of the red volcanic soil, are always narrow knife-edges, with no breadth at all, sloping steeply down each side and only varying a few hundred feet in level. Woolnough (**13**) attributes this razor-back character to "the great rapidity of sub-aerial denudation occasioned by the torrents of rain."

On these ridges there is a dense growth of small trees, like an overstocked plantation, in which *Podocarpus elata* predominates, with *Discocalyx fusca*, *Xanthophytum calycinum*, *Geniostoma rupestre*, *Graptophyllum Siphonostena*, *Psychotria griseifolia*, and the interesting shrubby epiphyte *Medinilla longicymosa*. The splendid orange *Dendrobium Mohlianum* was here quite abundant, but rarely seen below 3000 feet. The delicate little *Sarcochilus gracilis* seemed also limited to that altitude, with *Hydnophytum grandiflorum*. *Lycopodium Menziesii* and *L. serratum*, with *Elatostema sessile*, were ridge-types of undergrowths; also *Habenaria superflua*, whose vivid green flowers with their spider-like segments were not observed lower down.

These ridges are easily attainable by following up the streams, which usually start from a soak area just below their summit. The soak areas are always marked by the huge frond-like shoots of *Elatostema macrophyllum*, which runs up to 3000 feet. Once on the ridge progress is easy for miles, as the knife-edge gives a good idea of direction, a higher point here and there will afford a view, and if that is not sufficient the small trees come down easily. Often the edge will be broken down a few feet across where streams come off on each side.

RAIN FOREST.

The ridges are in many cases drier than the lower high forest, but in others where the aspect is south-east and the surface broadens out they partake more of the Rain Forest character. Then the difference is very marked. Luxuriant ferns form the chief undergrowth. Tree-ferns and palms like *Exorrhiza Wendlandiana* assert themselves, and down the south-eastern slopes the slender little palm, only known from Fiji, *Balaka Seemannii*, with a stem as thick as an average walking-stick, 2–3 m. high, was plentiful under the lofty trees. This rain forest extended up the slopes of Mt. Victoria to 3500 feet and yielded the interesting *Dryopteris Cesatiana*, discovered in New Guinea by Beccari and since only found by Horne in Fiji. The mosses, *Diphyscium submarginatum*, on stones, and *Rhodobryum Graeffeanum*, *Philonotis asperifolia*, and *Thuidium samoanum* were plentiful, with the Hepatic *Pleurozia gigantea* in pendent red tufts on the trunks of trees.

Approaching the summit of Mt. Victoria, *Dendrobium Mohlianum* was abundant as usual. *Glomera Gibbsiæ* and also *Carex Graeffeana* and *C. Gibbsiæ* were found as the moss growth became thicker towards the summit, where the moss forest in Copeland's sense prevailed.

Moss Forest.

From the beginning of the ridge the lovely *Agapetes vitiensis*, of myrtle habit, the 'sacred Vuga' of the Fijians, as it grows on the top of Kuvadra, their sacred mountain, dominated. The undergrowth disappeared, the ridge being covered with rotting logs piled one on top of the other as they fell, soaking with the moss which spreads all over the stunted wind-swept trees of the summit, covering them to the uttermost shoots with one thick pall. *Callicostella oblongifolia*, *Trichosteleum samoanum*, and *Ectropothecium calodictyon* were collected. Running thickly through the moss, almost obliterating it in places, the fennel-like fronds of *Trichomanes meifolium*, associated with *Hymenophyllum multifidum*, draped prostrate logs and the stems of the trees, the little hairy tufts of pendent fronds of *Polypodium Hookeri* showing where the two former species were less rampant. Embossed amongst the moss-covered logs *Cyrtandra vitiensis*, with its huge deep-green leaves, and *Plerandra Victoriæ* were in flower, and the beautiful *Dicksonia Brackenridgei* just showed its head above the rotting substratum.

Another patch of Moss Forest was seen on Col i Nadarivatu. Here the trees were larger, the altitude not being so great (3500 feet), but the almost impassable substratum of spongy moss-clothed rottenness, and the thick pall over the trunks of the trees prevailed, the exquisite *Spiridens Balfourianus*, which forms light green tufts about 2 dm. in length, growing out at right angles up the stems of tree ferns, being the dominating type. *Microstylis vitiensis* was here associated with *Dendrobium Mohlianum*.

Open Formations.

The High Forest begins to thin out in the north-western direction on the leeward side. The Nadalla valley, about 5 miles from Nadarivatu, on the way to Navai, has all been cleared, and now forms the chief pasturage for the capital little mountain ponies Mr. A. Joske breeds so successfully.

At the head of this valley is the deserted village of Mataculi, the inhabitants having been removed to Navai across the range, and this clearing is no doubt due to their previous cultivation. In many places damp areas are picked out by the Gladiolus-like flowers of *Phaius Wallichii*, Lindl. On the drier areas *Dodonæa viscosa, Scævola floribunda*, the Vuga, very much dwarfed, and the Vure (*Geissois ternata*), wild lemons, *Gahnia vitiensis*, and *G. aspera*, with *Pteris aquilina* var. *esculenta*, abound. Where drier still, as on the side of Matai Siga, where recent burning had exposed a section of superposed volcanic agglomerate and ash, reaching from the base to the top, it was being fast overgrown with reeds, amongst which were one or two plants of *Mussaenda frondosa*. Towards the top, at about 3000 feet, on the exposed agglomerate, *Plectranthes Forsteri*, *Cheilanthes hirta*, and *Pellæa geraniæfolia* were associated.

In this case the ridge was still forest-clad, as were also its north-westerly slopes, but the next peak, much higher, with all exposed agglomerate, was swathed in reeds, trees being limited to the stream areas on both slopes. From the top, a most magnificent view of the north-west country revealed range upon range of sun-baked hills, deep red in colour and shorn of all forest-growth.

In the vicinity of Nadarivatu the forest originally ran up to the edge of the escarpment, and does so still in one small patch, left as a very necessary wind screen. The rest shows secondary scrub- and fern-covered areas, according to the depth of soil. On the extreme edge most of the shrubs and trees widely spread in Fiji seemed to occur, viz., *Alphitonia excelsa*, *Guioa rhoifolia*, *Weinmannia affinis*, *Coprosma Imthurniana*, the fœtid *Geniostoma rupestre*, the profuse flowering *Decaspermum fruticosum*, *Spiræanthemum vitiensis*, *Wikstrœmia viridiflora*, *Acalypha insulana* and *A. repanda*, *Melastoma denticulatum*, with *Psychotria Gibbsiæ*, *Croton Verreauxii*, and *Alstonia plumosa*. Where the shrubby growth eased off on thinner soil and a more exposed surface, *Scævola floribunda* and *Metrosideros villosa*, clipped hard and distorted in a northerly direction, proved the force of the wind. Here *Dianella intermedia* and clumps of *D. nemorosa* would push up through the thick growth of *Lomaria capensis*, *Pteris aquilina* var. *esculenta*, *Balantium stramineum*, and *Gleichenia linearis*, with the ubiquitous pink heads of *Spathoglottis pacifica* on peduncles from 2 dm. to over a metre in height, the leaves varying accordingly. In the steepest and most exposed places, a thick reed-growth reached down to the valley 2000 feet below. Further along, on the more sheltered shoulder, down which the road winds in zigzags to the village of Waikubakuba at the base, there is some cultivation of yams and kumara (sweet potato) where the reeds have been cleared. *Homalanthus nutans*, *Mussaenda frondosa*, and *Piper Gibbsiæ* were here at home, and the South American *Cestrum nocturnum* abounded.

In the woods fringing the streams, *Bœhmeria platyphylla*, *Amaroria soulameoides*, *Croton Verreauxii*, and *Cyrtandra involucrata* were found. Further down, in some sheltered spots still forest-clad, fine trees of *Leea sambucina* and *Guioa rhoifolia* were in flower. All these slopes are annually fired by the natives, for the purpose of collecting the wild yams. Coconut, papaw and banana are cultivated down these slopes—none of which can be grown at Nadarivatu, on account of the exposure to wind.

Around Waikubakuba, nestling at the bottom, there is a certain amount of cultivation, which one passes through going over the plain to the base of Koro Levu, a mountain 3000 feet high, bare and barren, which forms part of a ridge stretching to the sea. This part of the plain is intersected by the streams collected on the ridge. Groves of Kavika (*Eugenia moluccensis*), Leba (*E. neurocalyx*), and Ivi (*Inocarpus edulis*) occur on the banks, of course originally planted and now sheltering the banana plantations between the ramifications of the streams. The soil here seems chiefly soapstone, which bakes and cracks in the sun. Beyond this cultivation zone *Eugenia rivularis* and *Pittosporum Brackenridgei*, with *Hoya australis* twining up their stems, were flowering in the woods fringing the streams and characteristic of this Leeward country.

On the lower slopes of the mountain, *Rynchospora aurea* abounded in marshy areas, and in some open places Yaka (*Pachyrrhizus trilobus*) and *Lagenospora Pickeringii*; otherwise the reeds, sometimes over 6 ft. high, luxuriated up to the top. The native tracks run like tunnels through this growth, quite invisible to the ordinary eye and impassable in European clothes. The summit, 3000 feet in height, was the usual knife-edge type, broadening out in the highest part, where, the reeds (associated with *Balantium stramineum* and *Gleichenia linearis*) not being very high, a magnificent view was obtained over the open country and the forest-clad ranges behind. Fine wild lemon-trees fruiting abundantly were growing towards the edge, which was fringed by the trees of the soak areas on the mountain-side. In these tree-clad soaks the ground was quite parched underneath, and there was little undergrowth beyond some ferns. The breadth of the stone-swept tract testified to the source of the stream and showed how the water must pour down from the summit in the rainy season. These trees could not possibly hold sufficient water to feed the innumerable streams which rise on the steep slopes of this Koro Levu ridge, and one must suppose that the luxuriant reed-growth, covering the ground thickly where trees cannot grow, not only binds the soil together, but acts as a reservoir for holding water.

Near Tavua, the nearest coast-town, there is a great deal of sugar-cane cultivation on the alluvial flats of the Tavua river, which are apparently of old mangrove formation. About two miles off the road are some hot springs, to reach which you have to pass over an undulating ridge and furrow country, the furrows generally forming small savannas of the grotesque *Pandanus odoratissimus*. My pony fed greedily on the leaves of this plant, which, cut up and mixed with the refuse of molasses, is the staple food of the mules belonging to the Sugar Company. The hot springs formed tiny streams, covered by a thick yellow scum of algæ, probably bleached by the action of the water, and fringed so thickly with overhanging grasses and sedges, that I did not believe the guide, when he put his foot in and suddenly withdrew it to show the water was hot. The temperature, however, proved to be 59° C. The Algæ collected were *Navicula viridis*, *Gomphonema intricatum*, *Nitzschia Palea*, *Phormidium tenue*, *P. laminosum*, and *P. luridum*, all species previously known in similar situations.

At Tavua large patches of *Acrostichum aureum* with Mangroves preceded the Mangrove swamp, which shelved in shallow water nearly to the reef, necessitating a long row out by boat to pick up the coasting steamer. This formation seemed to be increasing its area.

These notes being limited to one collection, and that including only the species in flower at a certain season in one particular locality, are necessarily very scanty, forming the barest outline of prevailing conditions.

In a country whose flora is only known from sporadic collections, it is difficult to estimate the correct terms. Trees, for example, like the Vuga and Vure, may flower when only one foot high, and as the clearings are the best collecting-grounds, it is difficult to decide what remains a shrub or grows into a tree. In some cases help is derived from other collections, but in others, with plants like *Acronychia petiolaris, Hedycarya dorstenioides, Cyrtandra glabrata* and *C. involucrata, Casearia Richii, Psychotria platycocca,* and *Claoxylon echinospermum,* which were always found as shrubs in clearings fringing the deeper parts of the high forests, it would be impossible to say whether they were part of the forest flora or belonged to a different association. As I have indicated before, it would require a long series of observations and a good local knowledge of floral conditions to decide which species will be eventually crowded out and which persist as forest-trees.

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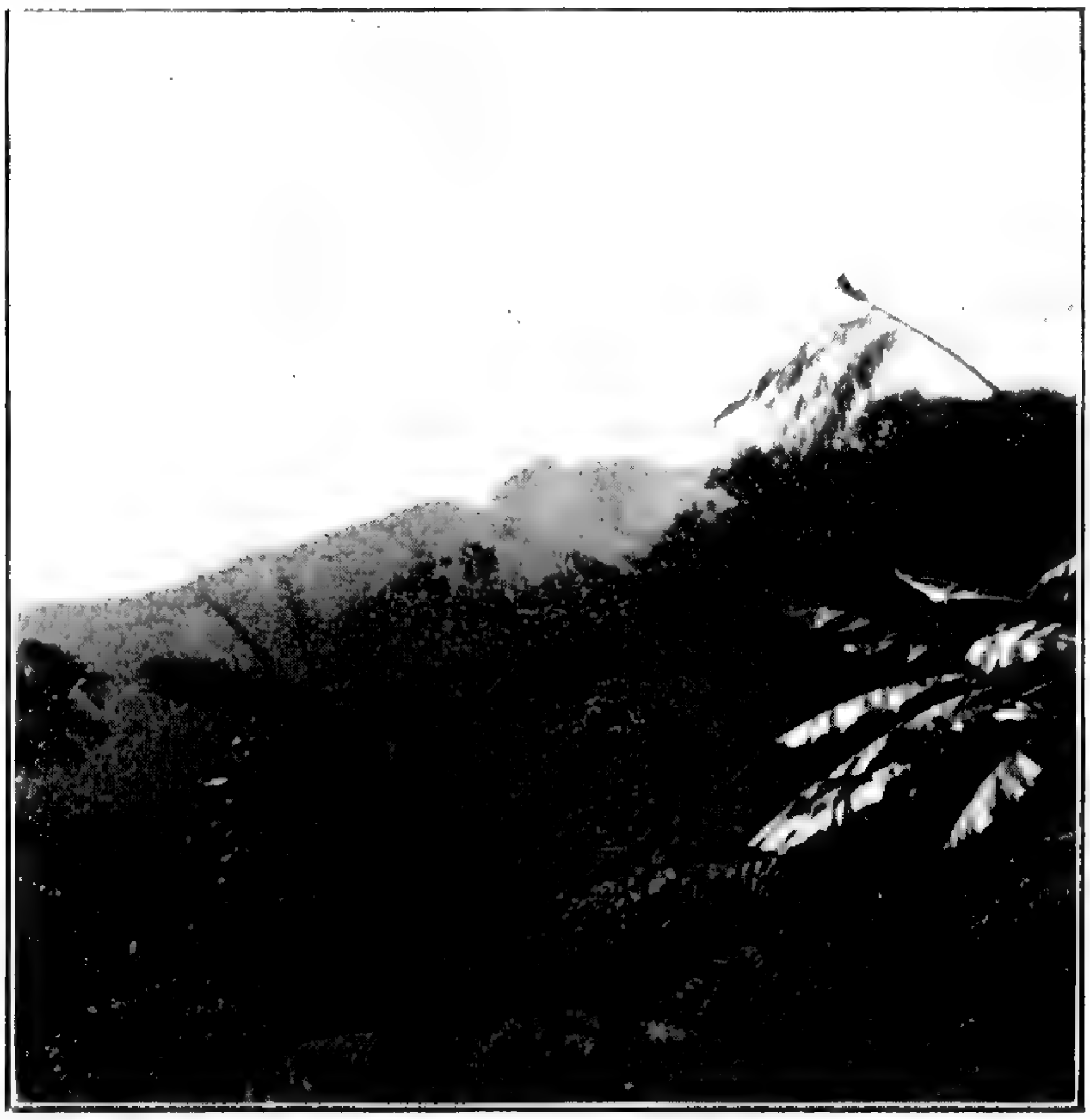


FIG. 1.

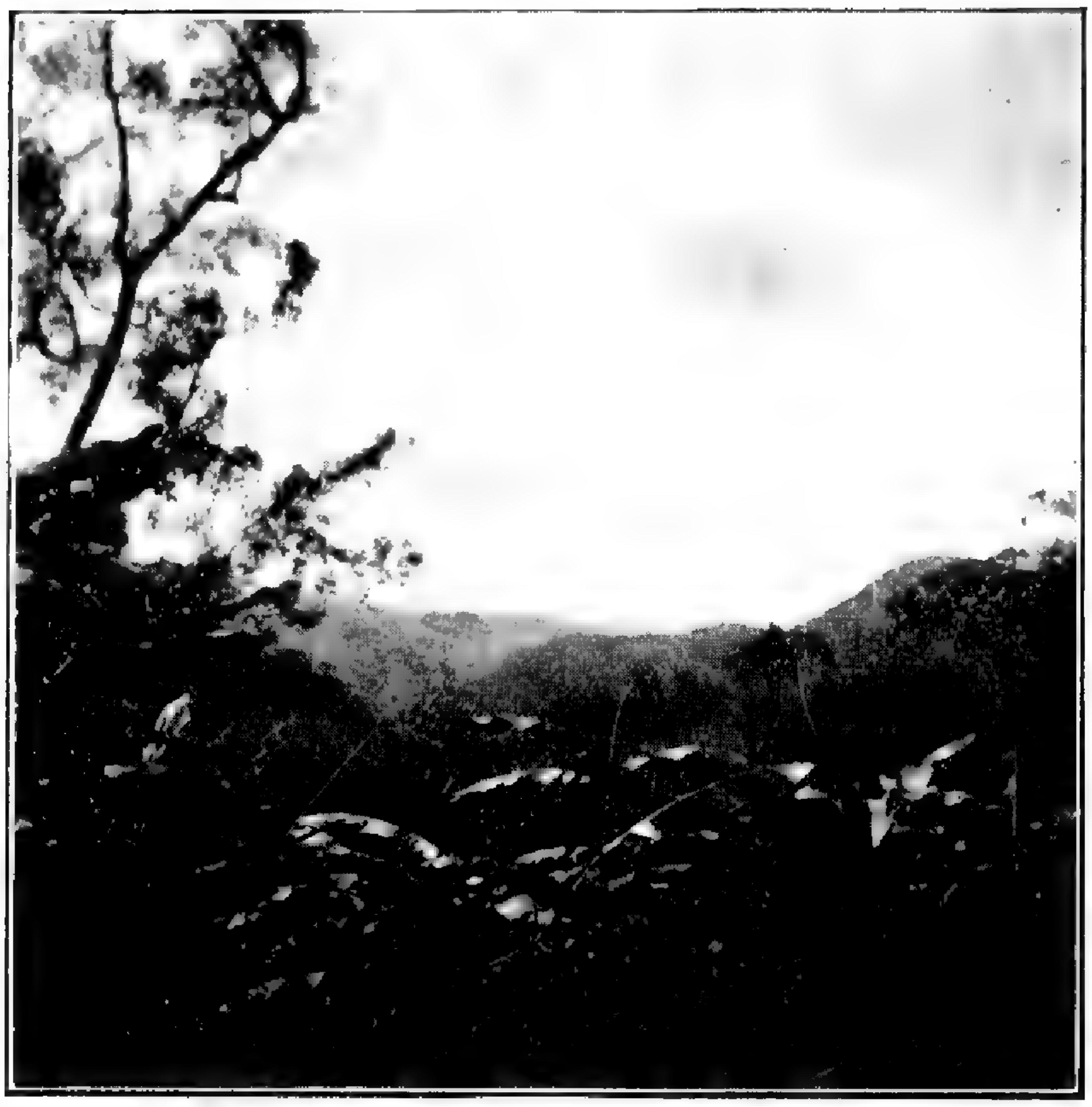


FIG. 2.

L. S. G., photo. Grout, sc.

VEGETATION OF MOUNT VICTORIA.

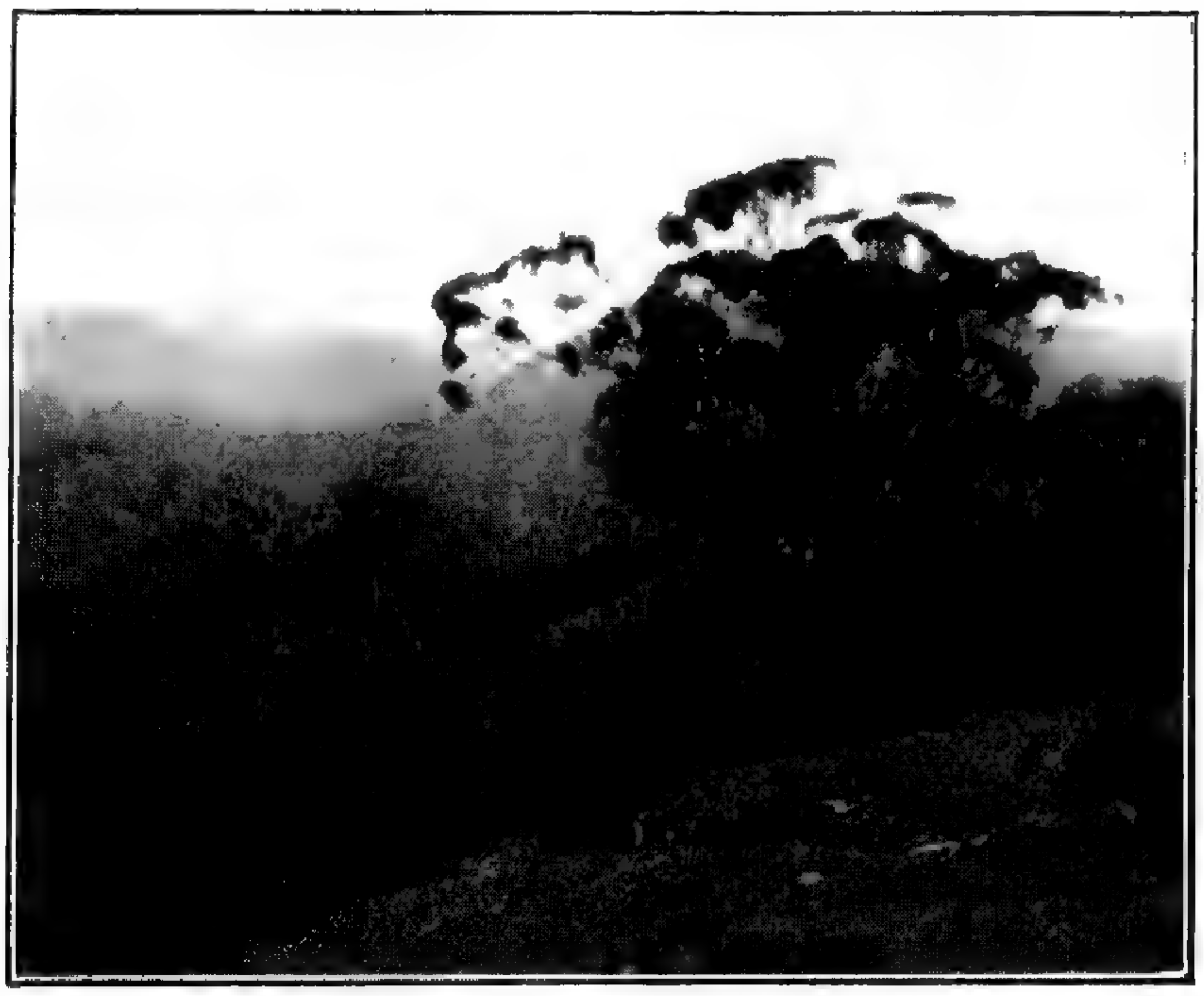


FIG. 3.

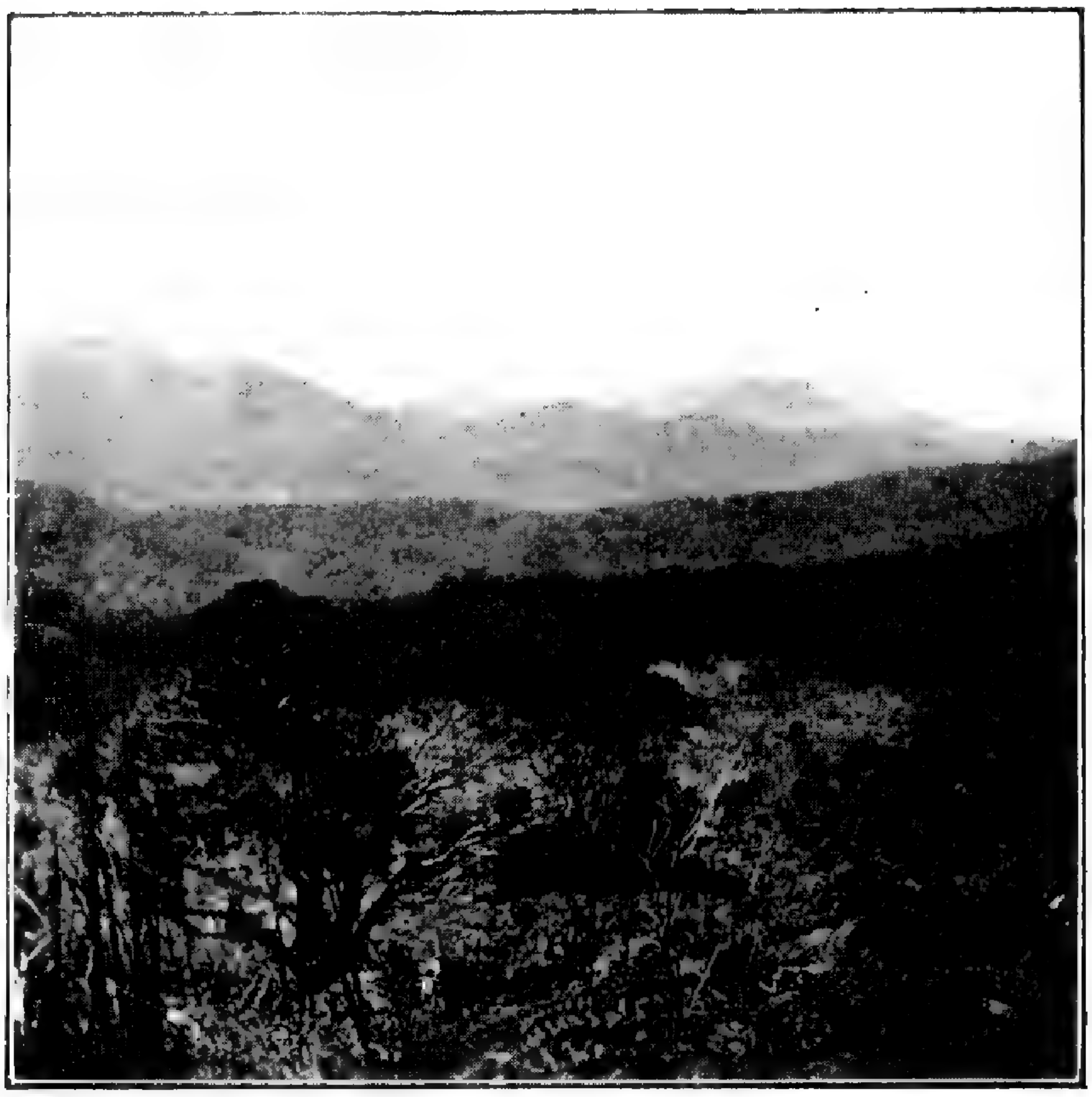
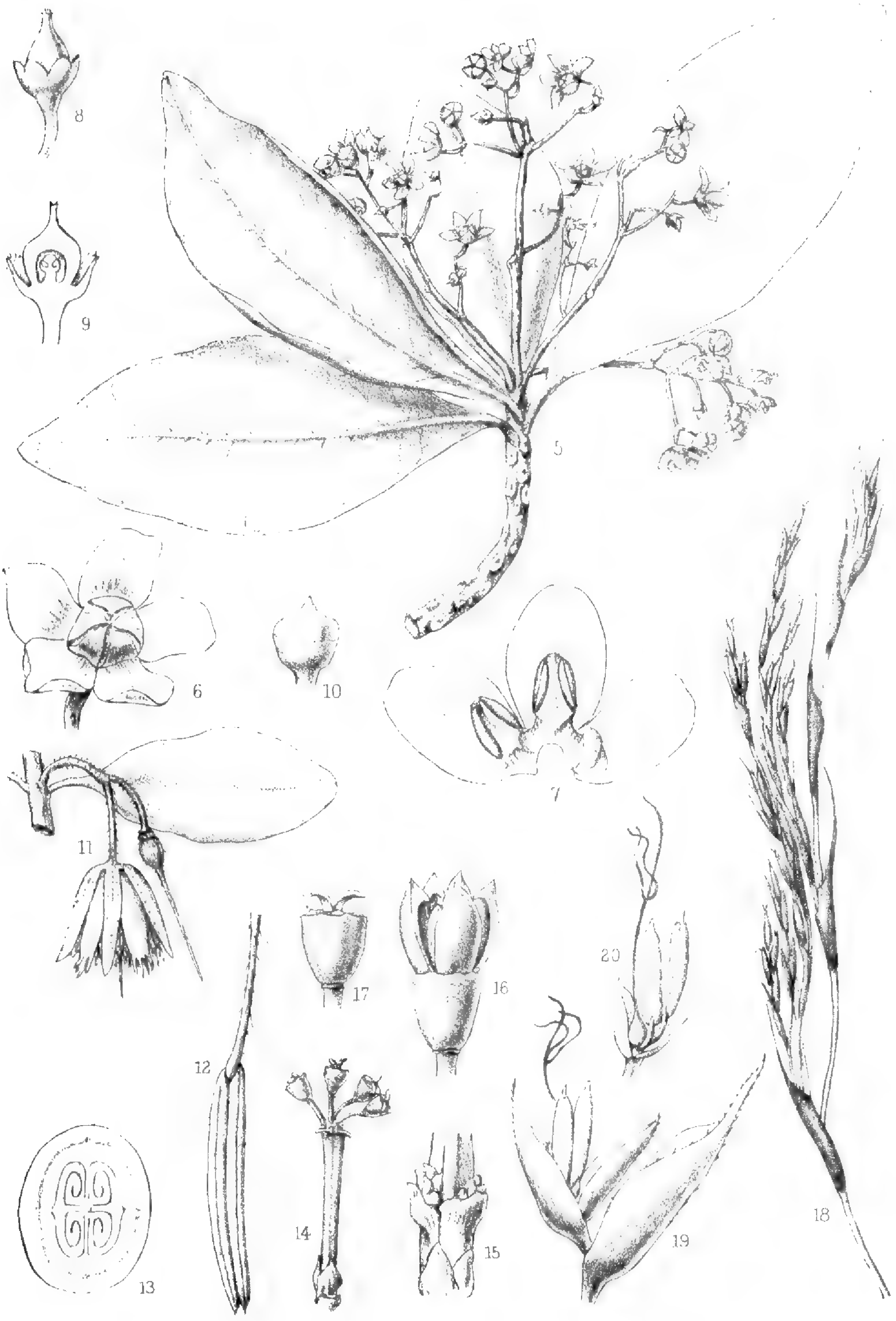


FIG. 4.

L. S. G., photo. Grout, sc.

VEGETATION OF NADARIVATU.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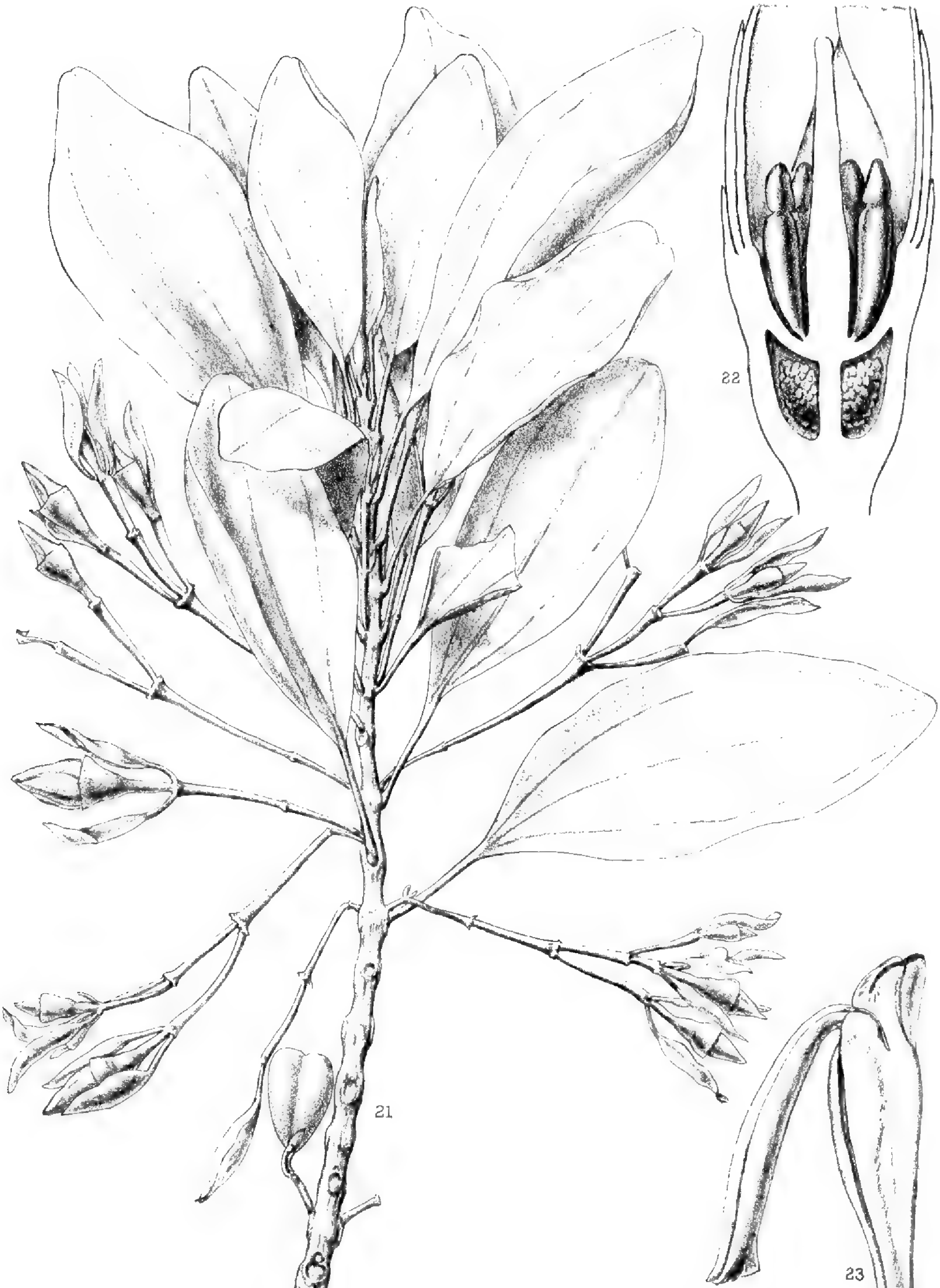
Highley Lith.
J. Pitcher Ltd imp.

DISCOCALYX FUSCA. **Gibbs** 5-10. ELAEOCARPUS KAMBI **Gibbs** 11-13.
POLYSCIAS CORTICATA. **Gibbs** 14-17. GAHNIA VITIENSIS. **Rendle** 18-20.



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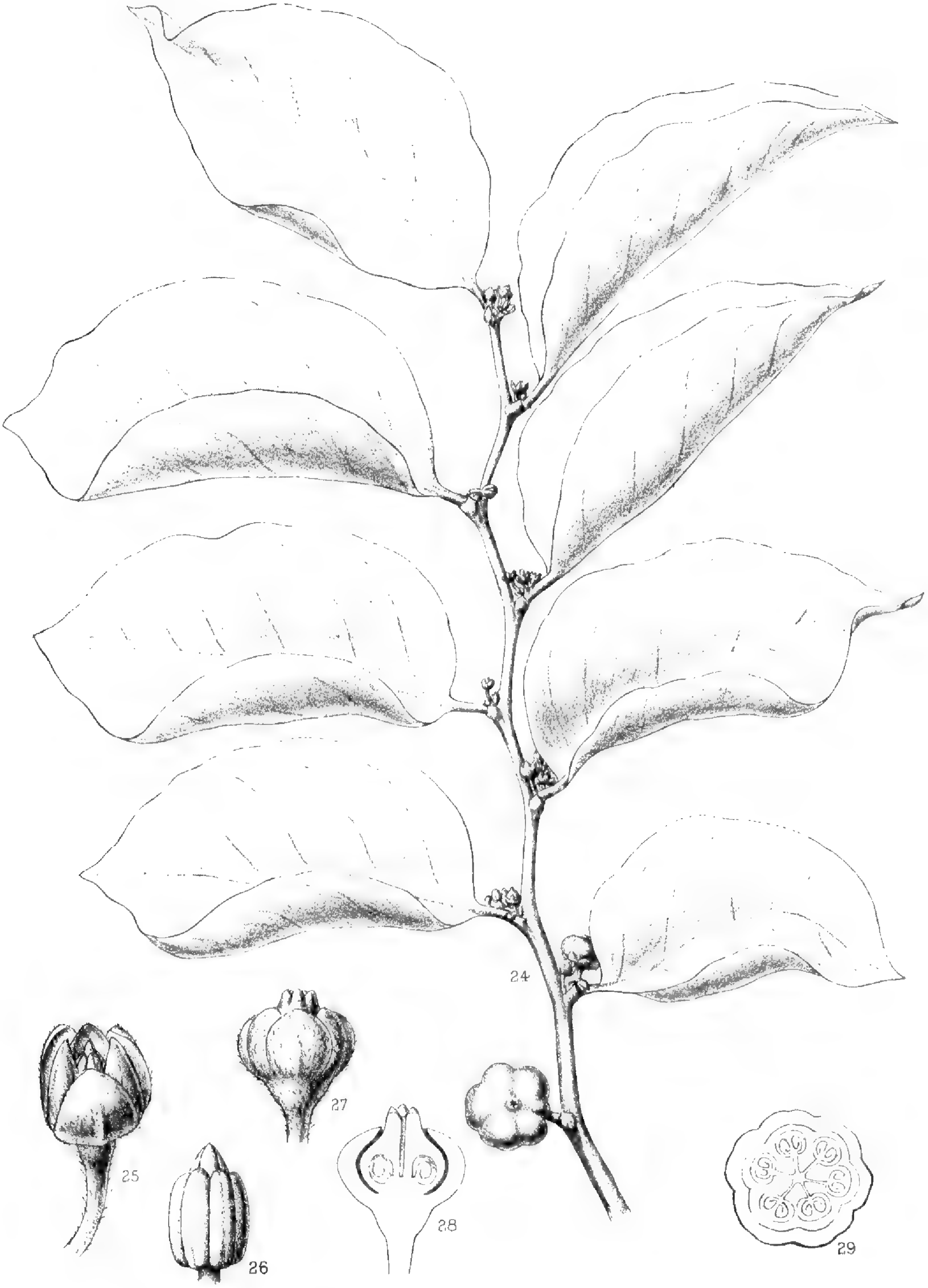
MEDINILLA LONGICYMOSA, *Gibbs.*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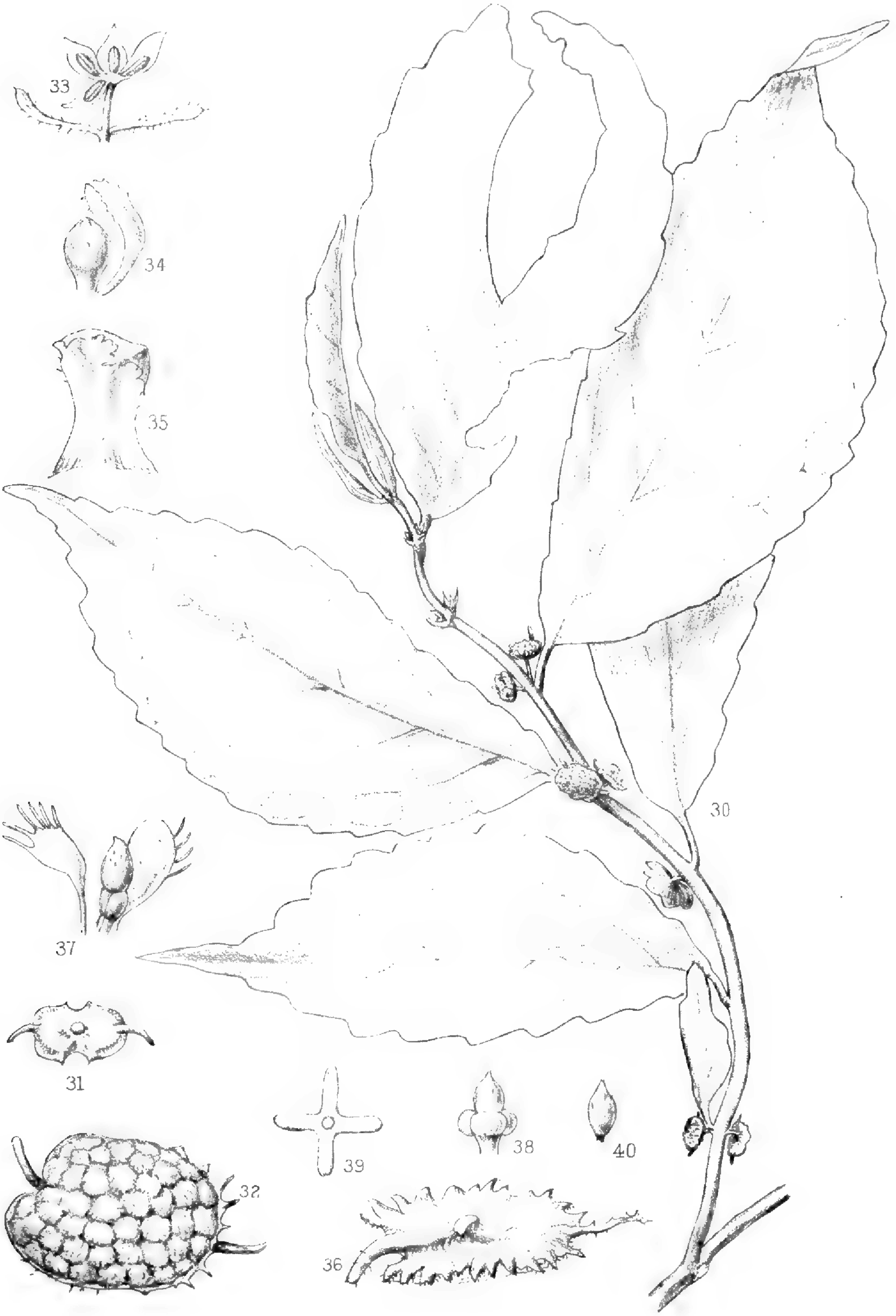
GLOCHIDION ANFRACTUOSUM, *Gibbs*.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L. S. G. & H. del.
Highley, Lith.
J. Pitcher Ltd. imp.

ELATOSTEMA FRUTICOSUM, ***Gibbs***.

13. Woolnough, W. G.—The Continental Origin of Fiji. Proc. Linn. Soc. N.S. Wales, xviii. (1903) pp. 457–496, tt. 22–34.
14. Guppy, H. B.—Observations of a Naturalist in the Pacific. London, 1906.

(References to papers not relating to Fiji are given in the text.)

EXPLANATION OF THE PLATES.

Plate 11.

Fig. 1. *Alpinia Boia* and *Alsophila* sp. Lower peak of Mt. Victoria in the distance.
2. Looking S.E. from the lower spurs of Mt. Victoria. *Alpinia Boia* in the foreground. *Freycinetia vitiensis* on a tree to the left.

Plate 12.

Fig. 3. *Metrosideros villosa* as forest-tree.
4. Open clearing on shallow soil, from the N.W. *Metrosideros villosa*, dwarfed, to the left. *Gahnia vitiensis* and *Pteris aquilina* in the foreground. *Scævola floribunda* behind. Mt. Victoria, farthest peak in the distance.

Plate 13.

Discocalyx fusca (figs. 5–10).

Fig. 5. Flowering branch, nat. size.
6. Open flower.
7. Portion of corolla, showing sessile stamens.
8. Ovary, style, and stigma, with calyx.
9. Longitudinal section through ovary.
10. Placenta with ovules.

Elæocarpus Kambi (figs. 11–13).

Fig. 11. Flower and leaf, nat. size.
12. Anther.
13. Transverse section of ovary.

Polyscias corticata (figs. 14–17).

Fig. 14. Peduncle with young fruit and bud bearing bracts at the base, nat. size.
15. Base of peduncle, showing bracts with buds in their axils.
16. Young flower.
17. Young fruit.

Plate 14.

Gahnia vitiensis (figs. 18–20).

Fig. 18. Branch of inflorescence, nat. size.
19. Spikelet with subtending bract, the two lower glumes separated exposing the flower.
20. Spikelet after removal of lower pair of glumes, showing the smaller upper pair and the flower.

Medinilla longicymosa (figs. 21–23).

Fig. 21. Flowering branch, nat. size.
22. Longitudinal section of flower-bud.
23. Stamen.

Plate 15.

Glochidion anfractuosum (figs. 24–29).

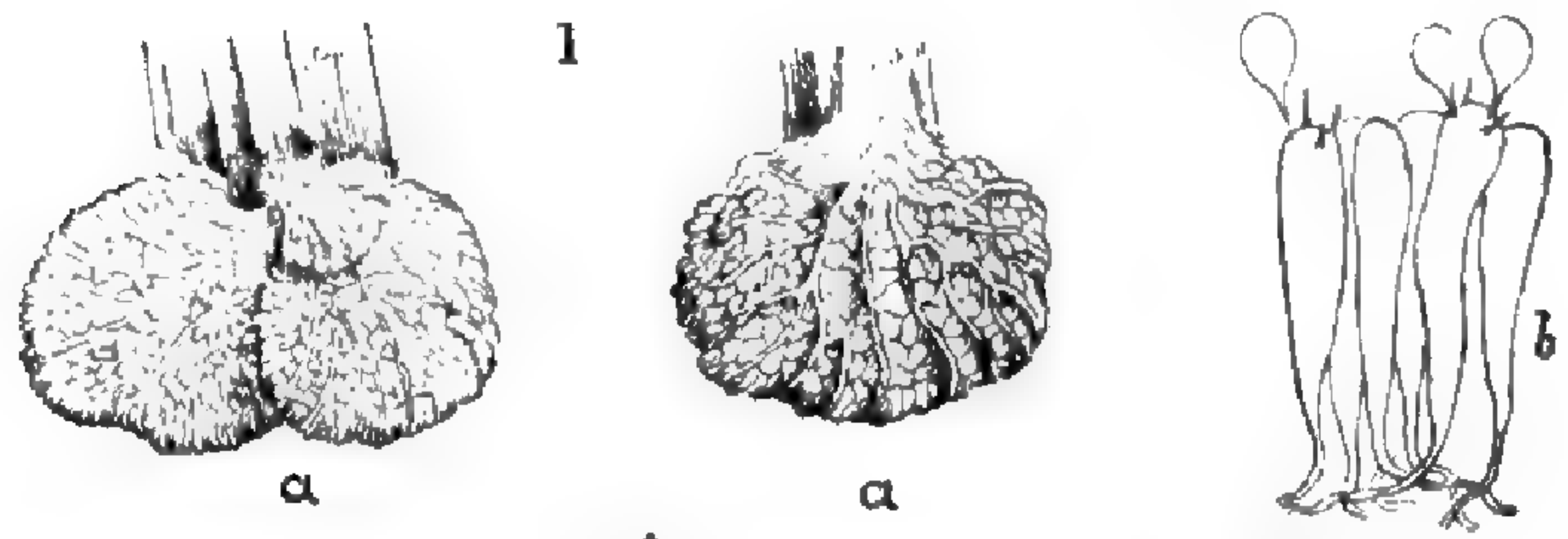
Fig. 24. Flowering branch, nat. size.
Figs. 25–26. ♂ flower, staminal column.
Figs. 27–28. ♀ flower and longitudinal section of same.
Fig. 29. Transverse section of ovary.

Plate 16.

Elatostema fruticosum (figs. 30–40).

Fig. 30. Flowering branch, nat. size.
Figs. 31–32. ♂ receptacle, dorsal view ; surface view.
Figs. 33–35. ♂ flower, with bracts.
Fig. 36. ♀ receptacle, dorsal surface.
Fig. 37. ♀ flower, with bracts.
Figs. 38–39. Perianth of ♀ flower with reflexed segments and the same flattened out.
Fig. 40. Fruit.

Text-figures.



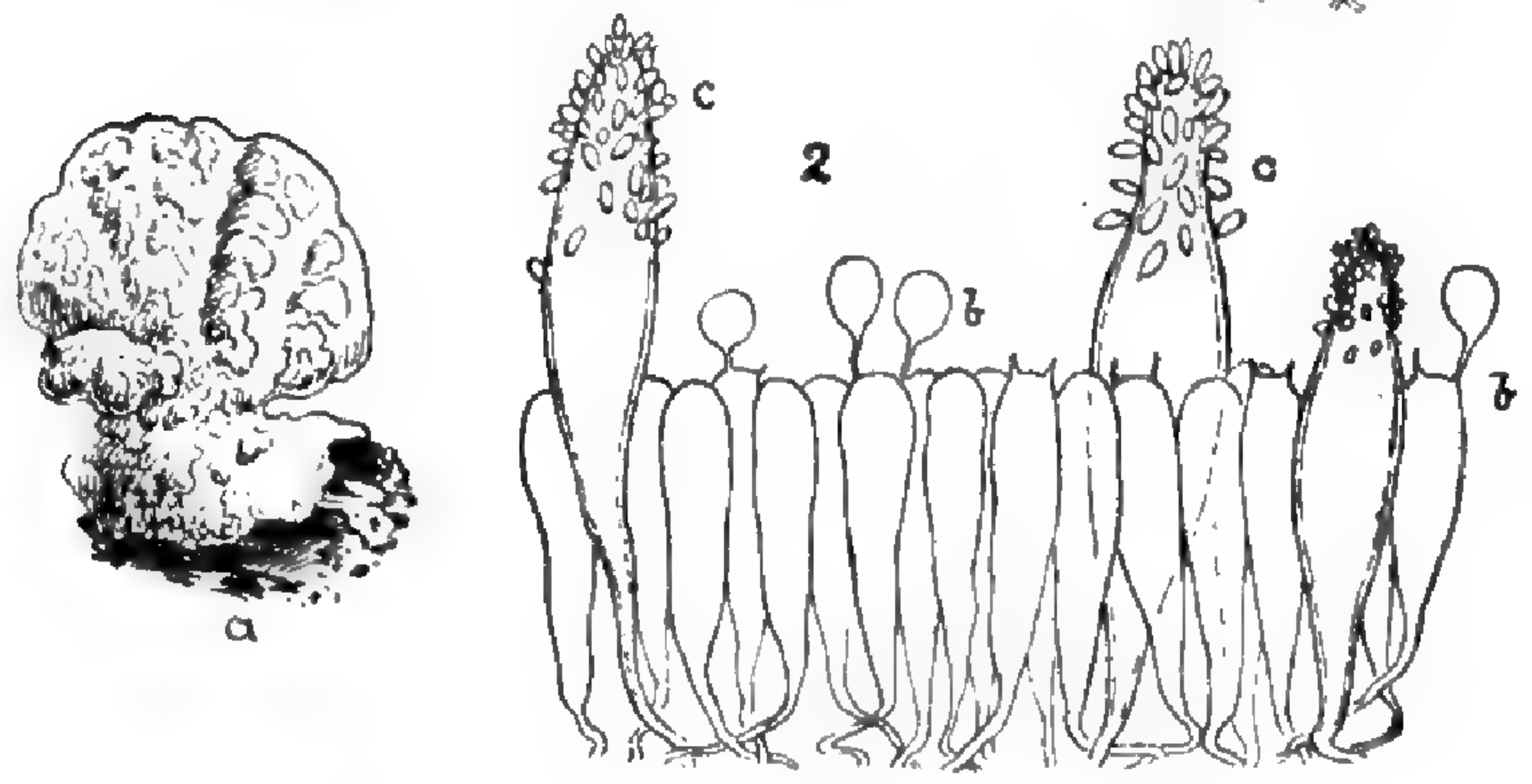


Fig. 1. *Laschia crenulata* (p. 198).
a, a. Upper and lower surfaces, nat. size.
b. Basidia and spores, × 500.

Fig. 2. *Laschia candida* (p. 198)
a. The plant, nat. size.
b. Basidia and spores, × 550.
c. Cystidia, × 550.

Some new Species of Malesian and Philippine Ferns. By Dr. HERMANN CHRIST, Basel. (Communicated, with an Introductory Note, by C. G. MATTHEW, Fleet-Surgeon R.N., F.L.S.)

[Read 17th June, 1909.]

[THESE Ferns are from collections made by me during the years 1906-8, whilst serving on H.M.S. 'Monmouth.' Certain of the novelties were this year submitted to Dr. Christ, of Basel, who kindly examined them, and described them as under.—C. G. M.]

ALSOPHILA MATTHEWII, *Christ*, sp. n.

Voisin d'*A. lepidoclada*, Christ, in Schuman & Lauterbach Nachträge z. Fl. Deutsch. Schutzgeb. i. d. Südsee, 37 (1905), et d'*A. truncata*, Brackenr.

Valde insignis stipite squamis griseis scariosis lucidis erecto-adpressis tecto, rachi costis costulisque squamis subulatis griseis pubeque densa rufa tomentosis, costulis subtus squamis rotundis umbilicatis bullatis sparsis, nervis lateralibus paucis (6 utrinque) inferioribus late furcatis, segmentis obtusis, infimis liberis herbaceis nigricantibus.

Inermis. Arborescens. Trunco tenui 65 cm. alto. Stipite 20 cm. longo basi digiti minoris, supra pennæ cygni crassitie, sulcato, squamis griseis lanceolatis acuminatis scariosis rigidis adpressis sed apice patulis carinatis integris imbricatis tecta. Fronde late ovata 45 cm. longa 30 cm. lata acuminata basi modice angustata tripinnatifida. Pinnis ultimis deflexis, cæteris patentibus. Pinnis bipinnatifidis, utrinque 8 infra apicem bipinnatum, approximatis late ovatis, mediis 18 cm. longis 9 cm. latis acuminatis fere sessilibus, pinnulis approximatis sessilibus basi ob pinnulos III ord. reductos aliquantum angustatis late lanceolatis 4 cm. longis 13 mm. latis acutiusculis, circa 12 infra apicem pinnatifidum, ad costam incisis, pinnulis III ord. sinu angusto ovato separatis, infimis minoribus remotis liberis basi ovatis, cæteris basi adnatis ligulatis obtusis, circa 12 utrinque, integris aut obscure crenulatis, nervis lateralibus obliquis remotis inconspicuis circa 6 utrinque, inferioribus late furcatis. Rachi costisque fulvis pube tenuissima subferruginea nec non squamis scariosis fuscis subulatis tectis, costulis supra strigoso-pubescentibus, subtus squamis rotundis umbilicatis bullatis vestitis. Textura herbacea tenera, colore atroviridi opaco.

Sori desunt. Inter species Philippinenses maxime pulchella!

Hab. Mt. Maquiling, Luzon, 3500 ft. in open forest. Slender trunk, 2 ft. high, unarmed, immature fronds prettily crimped; one small patch; none of the plants fertile. March 7, 1907; l. C. G. Matthew, 43.

TRICHOMANES SUBTRIFIDUM, *Matthew & Christ*, sp. n.

Voisin de *T. pyxidiferum*, L., mais nain et avec l'orifice de l'urcéole moins étalé et la fronde fortement dilatée à la base et, pour ainsi dire, tripartite.

Rhizomate capillaceo repente ramoso breviter tomentoso nigro. Foliis sparsis sed subcæspitosis. Stipite capillaceo nigro nudo uti tota plantula, 1·5 cm. longo. Fronde 2 cm. longa et basi æquilata deltoideo-elongata, bipinnatifida ad alam latam incisa, pinnis circa 6, superioribus brevibus apice bi- aut trifidis, sed basalibus oppositis valde auctis 14 mm. longis basi 5 mm. latis profunde incisis, lobis circa 5 utrinque, partim iterum incisis. Segmentis ultimis obtusis rarius acutis 2 mm. longis 1 mm. latis. Nervis tenuibus usque ad apicem loborum protensis. Soris in axillis anterioribus pinnarum positis, circa 3 utrinque, basi immersis campanulatis 1·5 mm. longis 1 mm. latis, ore libero modice dilatato, receptaculo non exserto. Textura tenui, colore dilute viridi.

Hab. Mt. Maquiling, Luzon, 3000 ft., rare; March 1, 1907; I. C. G. Matthew.

HYMENOPHYLLUM PENANGIANUM, *Matthew & Christ*, sp. n.

A cause de son réceptacle sortant de l'orifice de l'urcéole, cette espèce paraît de prime bord appartenir au genre *Trichomanes*. Mais l'ensemble de la plante, son tissu fort mince, olivâtre, et l'indusie non campanulé, mais ovale, la rougent plus naturellement parmi les *Hymenophyllum*. Le port est celui d'*H. lineare* d'Amérique ou d'une espèce voisine, mais la plante est lisse, sauf quelques rares poils de la rachis.

Rhizomate filiformi repente ramoso breviter tomentoso. Foliis sparsis sed cæspitoso-approximatis. Stipite nigro filiformi sed rigidiusculo pubescente 2 cm. longo. Fronde oblongo-ovato basi attenuato usque ad 7 cm. longo 2 cm. lato. Rachi pilosa usque ad mediam laminam libera supra alata. Fronde pinnata usque ad bi- imo tripinnatifida, pinnis erectopatentibus alternis, 6 ad 8 utrinque, inferioribus remotis, costa alata, usque ad 2 cm. longis 9 mm. latis, oblongis, pinnulis 3 utrinque, inferioribus bi- aut trifidis, lobis ultimis obtusis 2 ad 3 mm. longis 0·75 ad 1 mm. latis obtusis integris, nervis nigris conspicuis. Soris præcipue in axillis pinnarum antice, rarius in apice loborum superiorum positis, semiinsertis, ovatis, 1·5 mm. longis, valvis duabis manifestis semiovatis subintegris, receptaculo crasso exserto. Textura tenui diaphana, colore olivaceo, soris obscurioribus.

Hab. Penang, Government Hill, 2000 ft., Dec. 27, 1906; I. C. G. Matthew, 90.

ASPLENIUM PERAKENSE, *Matthew & Christ*, sp. n.

Voisin d'*A. præmorsum*, Sw., tirant vers *A. caudatum*.

Differt stipite elongato 21 cm. longo raris squamis subulatis sparso, infra ebeneo supra atroviridi, rachi interdum ebeneo interdum viridi, fronde magis elongata 28 cm. longa 7 cm. lata infra haud angustata, pinnis numerosis circa 30 utrinque, brevibus, 3·5 cm. longis more *A. caudati* confertis fere simpliciter pinnatifidis, auricula magna profunde trifida rachim tangente antice auctis, lobis 7 mm. longis 4 mm. latis cuneatis obtusis apice erosis, nervis sorisque flabellatis, soris numerosis tenuissimis ad apicem protensis, indusio griseo fere filiformi. Textura firme chartacea, colore læte virente opaco.

A. stereophyllum, Kze., et *A. Bernieri*, Cordem., différent par des segments bien plus étroits.

Hab. Perak: Gunong Hijan, Taiping, on a tree; Feb. 6, 1908; l. C. G. Matthew, 36.

ASPLENIUM SAIGONENSE, *Matthew & Christ*, sp. n.

Voisin d'*A. protensum*, Schrad., port d'*A. fuliginosum*, Hook. Différent du premier par les lobes moins allongés et les sores plus courts. *A. fuliginosum* a les pinnæ non lobés et un tissu coriace.

Rhizomate crasso obliquo, squamis setiformibus rigidis atropurpureis 7 mm. longis comato. Foliis paucis fasciculatis. Stipite 12 cm. longo pennæ corvinæ crassitie sulcato cum rachi atrato pilis nigris patentibus 1 ad 3 mm. longis dense vestito. Fronde pinnata, 35 cm. et ultra longa 5 cm. lata acuminata apicem versus pinnatifida basin versus angustata, pinnis 30 ad 40 utrinque, patentibus alternis confertis 3 cm. longis basi 9 mm. latis oblongis obtusiusculis sessilibus basi postice cuneatis antice rectangulis subauctis lateribus subparallelis lobatis, lobis obliquis haud ad mediam laminam tangentibus, circa 7 utrinque, loborum apice iterum inciso-dentato, nervis valde obliquis in lobis pinnatis, soris brunneis, circa 7 utrinque, linearibus vix 3 mm. longis, nec ad costam nec ad marginem protensis, indusio persistente angusto griseo integro. Textura rigide papyracea, colore fusco-virente opaco, faciebus glabris.

Hab. Saigon: Niu-chua-chang, among rocks in forest; Jan. 26, 1907; l. C. G. Matthew, 79.

The Acaulescent Species of *Malvastrum*, A. Gray.

By ARTHUR W. HILL, M.A., F.L.S.

[Read 17th June, 1909.]

THE small group of acaulescent Malvaceæ from the Andes, which form the subject of this paper, were referred by Gray to the genus *Malvastrum*, but were considered by Weddell to belong to *Malva* *. He retained the name *Malvastrum* for those plants in which the peduncles were adnate to the petioles and whose flowers were destitute of an involucre; these are now included in the genus *Nototriche* †. Weddell's acaulescent species of *Malva* were described as having flowers with or without an involucre and with the peduncles axillary or radical. The species with those characters, following Gray and Baker fil., are retained in *Malvastrum*. Weddell also broke up his andine Malvas into two sections, on the character of the presence or absence of the involucre; but it will be shown that the two species *M. nubigena* and *M. oriastrum* of his second section "Flores involucello destituti" apparently possess an involucre which may be caducous or sometimes aborted.

The acaulescent species of *Malvastrum* form a small and possibly not very natural group, since they probably represent the high alpine forms of this large genus and may perhaps be more closely related to some caulescent forms—living or extinct—than they are to each other. In their general facies they resemble the species of *Nototriche* and exhibit a similar adaptation to conditions. The plants have usually thick tap-roots in continuation of the woody underground caudices. In *M. Hauthalii* the caudex was found to be 1·5 cm. in diameter with a length of 18 cm. preserved. The caudices appear to be unbranched in almost every case, so that the plants possess only a single leaf-rosette. The leaves, borne on fairly long petioles, are spread out on the ground. They are usually more or less orbicular or ovate in outline, either entire, *M. alismatifolium*, or with a crenate margin, *M. betonicæfolium*, &c., or more or less deeply 5–7-lobed. They may be cordate, truncate, or cuneate at the base. The veins are usually palmate, but in some cases they are pinnately arranged. As a rule, the leaves are glabrous above, and if hairy below, the hairs are often confined to the veins. If the upper surface is hairy the lower is much more so. The tomentum, except in one or two species, is unlike that obtaining in *Nototriche*; the stellate hairs have usually only 2 or 3 rays or may be reduced to single bristles, and the plant thus appears to be

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* Weddell, Chl. And. ii. p. 273.

† Hill, A. W., in Engl. Bot. Jahrb. xxxvii. (1906) p. 576.

furnished with coarse strigose hairs. In *M. Richii* and *M. Weberbaueri*, however, the tomentum is composed of many-rayed stellate hairs. The leaf-teeth are furnished with two or three cilia in several species. The flowers often form a dense cluster in the centre of the leaf-rosette: they may be borne singly on the peduncles in the majority of cases, but in a few species the peduncles are 2-flowered (*M. acaule*, *M. Meridæ*, and *M. alismatifolium*), and in *M. Purdiaei* the flowers are borne 3–6 together in a small terminal cluster or capitulum. The involucral bracts may be either caducous or persistent, and they vary in shape from broadly ovate to filiform. In *M. nubigena* and *M. oriastrum*, Weddell thought them to be absent, but they have been noticed in the former species and are probably occasionally present in the latter also. The calyx is usually hairy on the inside of the segments and in every species appears to be furnished with 5 large, more or less triangular, glandular nectaries at the base, as in the genus *Nototriche*. The corolla is like that in *Nototriche*; the corolla-tube, however, is only from 1–2 mm. in length and the petal bases and the base of the column are covered with stellate hairs. The stamens are usually numerous and arranged in a globose or cylindrical head; in *M. nubigena* the filaments all spring from the tube at the same spot and the anthers are arranged in a corymbose fashion. The carpels are of three types: two species possess beaked carpels like those found in *Nototriche*, but in all the others the carpels are reniform and rounded at the apex. This larger group, however, can be broken up into two sub-groups, in one of which the carpels are wrinkled on the back, while in the other they are smooth and covered with stellate hairs.

The Acaulescent *Malvastra*, though showing a somewhat similar geographical distribution to *Nototriche*, and similar biological features, appear to prefer very different situations. Instead of growing in volcanic ash or on bare hillsides, as is usually the case with *Nototriche*, these *Malvastra* are to be found on the argillaceous soils of the valleys or growing in conjunction with other plants.

The range of this acaulescent section extends from the Sierra of Santa Martha in Venezuela as far as the south of Bolivia and Northern Argentina. No acaulescent species have been recorded from Chile, though *M. humile* from the Cordillera of Santiago has assumed a somewhat similar habit of growth.

The comparison of the geographical range of this section with that of *Nototriche* is of some interest, since the *Malvastra* extend to the extreme north of South America, but do not attain to the southern limits reached by *Nototriche*.

The section *Acaules* contains at present 18 species, a key to which and descriptions, with notes, now follow.

MALVASTRUM, *A. Gray.*

Sectio Acaules, *A. W. Hill.*

Clavis specierum.

- Carpella rostrata.
  - Rostra 1·5 mm. longa, sparse hirsuta; calyx extra plus minusve glaber; corolla purpurea .... 1. *M. purpureum.*
  - Rostra circa 1 mm. longa, dense stellato-tomentosa; calyx extra strigoso-hirsutus; corolla lutea .... 2. *M. Weberbaueri.*
- Carpella dorso verruculosa.
  - Carpella apice hirsuta; folia ovata vel obovata, cordata, marginibus integris vel crenatis.
    - Folia levia, marginibus integris vel apice paullo crenatis.
      - Folia ovata vel orbicularia obtusa; calycis segmenta acuta .... 3. *M. parnassiæfolium.*
      - Folia obovata acuta; calycis segmenta acuminata .... 4. *M. alismatifolium.*
    - Folia paullo rugosa, marginibus crenatis .... 5. *M. betonicæfolium.*
  - Carpella omnino glabra; folia orbicularia, crenata vel ad medium 5-lobata.
    - Folia orbicularia, crenata.
      - Folia late crenata; flores conspicui, purpurei .... 6. *M. Fiebrigii.*
      - Folia anguste crenato-dentata; flores parvi, albi...... 7. *M. rhizanthum.*
    - Folia plus minusve ad medium 5-lobata.
      - Folia glabra, lobis profunde crenatis .... 8. *M. nubigena.*
      - Folia dense hirsuta, lobis dentatis.................. 9. *M. Hauthalii.*
- Carpella levia, dorso hirsuta.
  - Flores in capitula 2–5-flora aggregata, bracteis glabris, pedicellis brevissimis.
    - Folia fere ad medium 5-lobata, basi cordata; capitula 4–5-flora..................................... 10. *M. Purdiaei.*
    - Folia late ovata vel sub-orbicularia, basi plus minusve cuneata; capitula 2-flora...... .... 11. *M. Meridæ.*
  - Flores singuli vel pedunculi 2-flori, pedicellis longis, bracteis margine ciliatis vel glabris.
    - Pedunculi petiolis longiores; bracteæ ovatæ .... 12. *M. Stuebelii.*
    - Pedunculi petiolis breviores; bracteæ subulatæ vel filiformes.
      - Folia orbicularia, basi cordata marginibus crenatis; flores parvi.
        - Calyx extra glaber, segmentorum marginibus hirsutis. 13. *M. crenatum.*
        - Calyx extra dense stellato-hirsutus .... 14. *M. Richii.*
      - Folia ovata vel sub-orbicularia, basi rotundata vel cordata, marginibus crenato-serratis; flores conspicui .... 15. *M. Bakerianum.*
      - Folia ovata, basi cuneata, marginibus late serratis; flores conspicui .... 16. *M. oriastrum.*
      - Folia late triangularia vel suborbicularia plus minusve 5-lobata.
        - Folia plus minusve glabra, marginibus minute serratis; pedunculi vulgo 2-flori...................... 17. *M. acaule.*

Folia dense hirsuta, marginibus crenatis; pedunculi uniflori .... 14. *M. Richii.*
Folia ultra medium 5-lobata.
Folia basi plus minusve cordata; bracteæ subulatæ, strigoso-hirsutæ .... 18. *M. Englerianum.*
Folia basi cuneatæ; bracteæ lineares, glabræ, sæpius caducæ .... 16. *M. oriastrum.*

1. MALVASTRUM PURPUREUM, *A. W. Hill.*—*Fruticulus* depressus; caudex subterraneus, lignosus, firmus. *Folia* rosulata, solo adpressa; petiolus 2–3 cm. longus, parce pilosus; stipulæ membranaceæ, ovato-lanceolatæ, acutæ; lamina ambitu ovata vel pentagona, basi cordata, 1·3–2 cm. longa, 1–2 cm. lata, glabra vel sparsissime pilosa, profunde 3–5-lobata, lobis irregulariter incisis lobulis ovato vel obovato-oblongis obtusis congestis. *Flores* singuli, pedunculis 1–2 cm. longis subglabris vel dense pilosis; involucrum caducum, prophyllis 2–3, 5–7 mm. longis lanceolatis subacutis glabris vel margine pilosis. *Calyx* 1–1·1 cm. longus, sub medio 5-lobus, segmentis 6–7 mm. longis triangulari-ovatis acutis, extra glaber vel rarius parce pilosus, segmentis intrastellato-ciliatis. *Corolla* purpurea, plus minusve 1·8 cm. longa; petala obovato-oblonga, rotundata vel retusa, 7 mm. lata, basi in tubum circa 2 mm. longum coalita uti staminum tubus basi stellato-tomentosum. *Stamina* in caput plus minusve elongatum instructa. *Carpella* circa 10, birostrata, rostris 1·5 mm. longis, dorso stellato-ciliata.

Malva Purdiaei, Planch., in Triana et Planch., Prod. Flor. Nov. Granat. p. 154; Wedd. in Chl. And. ii. p. 275; non *Malvastrum Purdiaei*, A. Gray, ex Triana et Planch. l. c. et ex Wedd. l. c. p. 275.

Malvastrum Purdiaei (A. Gray), Baker fil. in Journ. Bot. xxix. (1891) p. 171, partim (?).

VENEZUELA: New Granada, *W. Purdie*; summit of the Paramo La Colorado (very rare), *Purdie*, Sept. 1845 (Herb. Kew.)!

This plant, collected by Purdie at the summit of the Paramo La Colorado, New Granada, in Sept. 1845 and again in 1846, is said to be "very rare" and "a showy little plant." It was described by Planchon under the name *Malva Purdiaei*, in 1862, and was considered to be synonymous with the *Malvastrum Purdiaei*, A. Gray, described in the Botany of the U.S. Expl. Exp. in 1854, though the discrepancy between the one-flowered inflorescences of the Purdie plant of Planchon and the capitulate inflorescences of the plant described by Gray is pointed out. Weddell doubtfully accepts the same position. Planchon suggests that Gray may have had some examples of *Malva acaulis β. granatensis*, Planch. et Lind., before him when he made his species *M. Purdiaei*, and Weddell appears to incline to the same view.

On examining the material at Kew it has been found that there are two distinct plants collected by Purdie—one the original *Malvastrum Purdiaei*, A. Gray, which had been placed with a specimen of Linden's labelled

Malva acaulis β. granatensis, and the other the *Malva Purdiaei*, Planch., which is now renamed *Malvastrum purpureum*, A. W. Hill. The specimen collected by Linden in New Granada, no. 1425 in Herb. Kew., does not belong to *Malvastrum Purdiaei*, A. Gray, but has been referred to a new species, *M. Meridæ*, A. W. Hill.

M. purpureum is readily distinguished from *M. Weberbaueri*, which has similar fruits, by the usually glabrous character of its laminæ and calyces and the deep purple colour of the flowers. The leaves are deeply lobed and the lobes bear numerous blunt finger-like lobulæ. The involucral bracts fall off early in this species, as appears to happen in *M. oriastrum*. *M. purpureum* shows no very marked affinity for any other species.

2. MALVASTRUM WEBERBAUERI, *E. Ulbrich in Engl. Bot. Jahrb.* xlii. (1908) p. 115.

PERU: Dep. Ancachs, Prov. Cajatambo, Ocros, 3500–3600 m., *Weberbauer*, 2760 (Herb. Berol.) !

This species is very distinct in appearance owing to the velvety or dusty felt of minute stellate hairs which covers the leaves and gives the plants a yellowish ashen-grey colour. In addition to the finer tomentum, coarse strigose hairs are to be found on the petioles, and on the veins at the back of the lamina, as well as on the peduncles and calyces. The leaf-margin is slightly upturned. The flowers are described by Weberbauer as sulphur-yellow in colour.

3. MALVASTRUM PARNASSIÆFOLIUM, *A. Gray in Bot. U.S. Expl. Exp.* p. 150 in adnot.; descr. emend. et ampl.—*Fruticulus* depressus; caudex subterraneus, fusiformis, tuberosus. *Folia* rosulata; petiolus 3–5 cm. longus, plus minusve glaber vel parce setosus; stipulæ membranaceæ, glabræ, lanceolatæ, acutæ, circa 1 cm. longæ; lamina late ovata, basi cordata, 1·5–1·8 cm. longa, 1·2–1·6 cm. lata, glabra vel subtus nervis pilosis, marginibus integris vel prope apicem paullo crenatis. *Flores* singuli, pedunculis 3–7 cm. longis parce setosis; involucrum persistens, prophyllis 1–2 linearibus, 5 mm. longis, glabris. *Calyx* 9–11 mm. longus, sub medio 5-lobus, segmentis 6–7 mm. longis lanceolatis acutis, extra parce setosus, segmentis intra setoso-tomentosis. *Corolla* violacea vel alba, 1·5–2 cm. longa; petala 1·3–1·8 cm. longa, 7–8 mm. lata, obovato-unguiculata, obtusa, basi in tubum circa 2 mm. longum coalita, uti staminum tubus infra stellato-tomentosa. *Stamina* numerosa, in caput elongatum instructa. *Carpella* 10–12, reniformia, dorso paullo verruculosa, apice præsertim stellato-tomentosa.

Sida parnassiæfolia, Hook. Ic. Pl. iv. t. 385.

Malva parnassiæfolia, Wedd. Chl. And. ii. p. 275.

Malvastrum parnassiæfolium, Baker fil. in Journ. Bot. xxix. (1891) p. 171, partim.

Ecuador: Andes of Quito, on the road from Guamote to Achupallas, about 4000 m., *Jameson* (Herb. Kew.)! (Ic. in Hook. Ic. Pl. iv. t. 385.)

Peru: Dep. Cajamarca, Coymolache Pass above Hualgayoc, 4000–4100 m., *Weberbauer*, 3993 (Herb. Berol.)!

The confusion which has arisen between this species from Ecuador and Northern Peru and its supposed variety *β. lobulatum*, which is *M. nubigena*, is explained in the note under *M. nubigena.* Baker fil., *l. c.* p. 171, cites the localities for *M. parnassiæfolium* as Ecuador and Bolivia, apparently following the geography given in the 'Chloris Andina,' where (ii. p. 276) the habitat of the species is not distinguished from that of the "variety."

This species is closely related to *M. alismatifolium* and further notes are given in connection with that species. These two species are distinguished from all others by the usually entire leaves.

According to the note in Hooker's 'Icones' (*l. c.*) this plant was observed only in places where the turf produced a herbage of very stunted growth.

4. Malvastrum alismatifolium, *K. Schum. et Hieron. in Engl. Bot. Jahrb.* xxi. (1895) p. 318.

Peru: between Pacasmayo and Moyobamba, Punas near Centamal and Cumullca, *Stübel*, 39 (Herb. Berol.)!

This species and *M. parnassiæfolium*, A. Gray, which has been collected in the Dep. of Cajamarca, N. Peru, by Weberbauer, and also in the mountains of Ecuador by Jameson, are closely related, Weberbauer's specimens being of a somewhat intermediate type. *M. alismatifolium* is distinguished by its elongated, obovate, acute leaves with entire margins and by the acuminate sepals. In both species the peduncles are often longer than the petioles, and in *M. alismatifolium* 2-flowered peduncles may be found. The fruits are more or less reticulately wrinkled on the back and glabrous except for a small apical tuft of hairs.

5. Malvastrum betonicæfolium, *A. W. Hill.*—*Fruticulus* depressus; caudex subterraneus. *Folia* rosulata, solo adpressa; petiolus 3–7 cm. longus, plus minusve dense pilosus; stipulæ membranaceæ, lanceolatæ, acutæ, 1–1·5 cm. longæ; lamina ambitu ovata, basi cordata, 1·5–2·5 cm. longa, 1·5–2 cm. lata, margine crenata, subglabra, nervis subtus præsertim parce pilosis. *Flores* singuli, pedunculis 2–5 cm. longis supra præsertim dense strigoso-hirsutis; involucrum persistens, prophyllis 2, linearibus acutis vel ovato-lanceolatis acutis membranaceis glabris. *Calyx* 8 mm. longus, ad medium 5-lobus, segmentis ovato-lanceolatis acutis extra basi et ad margines parce pilosis intra tomentosis. *Corolla* purpurea; petala 1·3 cm. longa,

7 mm. lata, obovata, apice rotundata, fimbriata. *Stamina* in caput elongatum, 1 cm. longum instructa. *Carpella* verruculosa, apice paullo tomentosa.

Malvastrum Purdiaei, A. Gray, *β. huantense*, Baker fil. in Journ. Bot. xxix. (1891) p. 171.

PERU: Andes of Huanta, 3950–4260 m., *R. Pearce*, Feb. 1867 (Herb. Kew.)!

The ovate-cordate leaves have a very regularly crenate margin and do not show any trace of lobes. The surface of the lamina is somewhat wrinkled. The tomentum is composed of few-rayed strigose hairs, which are especially well developed on the upper parts of the peduncles. *M. Fiebrigii* appears to be the nearest ally of this species; it does not appear to be nearly related either to *M. Purdiaei* or to *M. parnassiæfolium* as has been suggested.

6. MALVASTRUM FIEBRIGII, *E. Ulbrich in Engl. Bot. Jahrb.* xlii. (1908) p. 113.

Sida parnassiæfolia, Hook., var. *β. lobulata*, Wedd., Griseb. in Pl. Lorentz. (1874) p. 42, n. 98.

BOLIVIA AUSTRALIS: near Puna Patanca, 3800 m., *K. Fiebrig*, 2963!

ARGENTINA: near Sierra de Tucuman, La Ciénega, *P. G. Lorentz*, 118 (Herb. Berol.)!

This plant was referred by Grisebach *l. c.* to *Sida parnassiæfolia, β. lobulata*, Wedd., with the added diagnosis "foliis circumcirca duplicato- v. inciso-crenatis." It differs from *M. nubigena* in its more or less orbicular leaves, cordate at the base, in the absence of well-marked lobes, and in the broad blunt crenulations of the margin. *M. Fiebrigii* appears to be related to *M. betonicæfolium*, and it is possible that the latter may eventually prove to be a varietal form of *M. Fiebrigii*. In *M. betonicæfolium*, however, the leaf-crenulations are much more numerous, the sepals more ovate, and the involucral bracts are broader. The two species are also separated on the character of the carpels.

7. MALVASTRUM RHIZANTHUM, *A. Gray in Bot. U.S. Expl. Exp.* p. 148; descr. ampl.—*Fruticulus* depressus, glaber; caudex subterraneus, fusiformis, lignosus, firmus. *Folia* rosulata, solo adpressa; petiolus 2–4 cm. longus, glaber; stipulæ lanceolatæ, acutæ, membranaceæ; lamina orbicularis, basi cordata, 1·5–2 cm. diametro, crenato-dentata vel duplicato-crenata, glabra. *Flores* singuli, congesti, pedunculis 5 mm.–1 cm. longis; involucrum persistens, prophyllis 3, 3 mm. longis linearibus. *Calyx* 4–6 mm. longus ad medium 5-lobus, segmentis ovatis subacutis, extra glaber, segmentis intus parce tomentosis. *Corolla* alba vel violacea, (?) 6 mm.–1 cm. longa; petala cuneata, retusa, 2·5–4 mm. lata. *Stamina* numerosa, in caput globosum

exiguum instructa. *Carpella* reniformia, glabra, muricata (*Gray*), matura non visa, verrucosa (*Matthews*).

Malva rhizantha, Wedd. Chl. And. ii. p. 276.

Malvastrum rhizanthum, Baker fil. in Journ. Bot. xxix. p. 171.

PERU: Andes above Baños, *Pickering* (Herb. Gray); Cerro Pasco, *Matthews*, 911 (Herb. Kew.)! *Matthews*, 894 (Herb. Mus. Brit.)!

The plants are glabrous throughout except on the inside of the calyx. Weddell, *l. c.* p. 276, suggests that the species is allied to his variety of *Malva parnassiæfolia*=*Malvastrum nubigena*. The fruits in the two species are certainly similar, but the orbicular leaves in *M. rhizanthum* have a regular crenate margin and are not deeply lobed as in *M. nubigena*; the flowers also are small and somewhat inconspicuous.

8. MALVASTRUM NUBIGENA, *Baker fil. in Journ. Bot.* xxix. (1891) p. 172; descr. emend. et ampl.—*Fruticulus* depressus; caudex subterraneus, lignosus, firmus. *Folia* rosulata, solo adpressa; petiolus 1–7 cm. longus, glaber; stipulæ lanceolatæ, acutæ, 9 mm.–1·2 cm. longæ; lamina ambitu ovata vel oblonga, basi cuneata vel cordata, 1–3 cm. longa, 9 mm.–2·5 cm. lata, supra glabra, subtus subglabra vel nervis præsertim et foliis junioribus strigoso-hirsuta, 5–7-lobata, lobis irregulariter plus minusve profunde crenatis vel lobuliformis margine ciliatis. *Flores* singuli, pedunculis 1–9 cm. longis glabris vel parce pilosis; involucrum caducum, prophyllis 1–3, 3–6 mm. longis linearibus vel filiformis glabris vel parce pilosis. *Calyx* 5–8 mm. longus, sub medio 5-lobus, segmentis 3–5 mm. longis triangulari-ovatis acutis, extra glaber, segmentis intus parce pilosis. *Corolla* violacea, basi purpurea, 1·4–2 cm. longa; petala oblongo-obovata, 6–8 mm. lata, truncata vel rotundata, basi in tubum circa 1 mm. longum coalita. *Stamina* in caput corymbosum instructa, filamentis longis. *Carpella* circa 10, reniformia, dorso verruculosa, glabra.

Sida nubigena, Walp. Nov. Act. xix. Suppl. i. p. 307.

Malva nubigena, Wedd. Chl. And. ii. p. 276.

Malva parnassiæfolia, *β. lobulata*, Wedd. Chl. And. ii. p. 275; Bull. Soc. Bot. Fr. xii. (1865) p. 82.

Nototriche incisa, Turcz. in Bull. Soc. Imp. Nat. Moscou, xxxvi. (1863) p. 567; *cf.* Hill, in Engl. Bot. Jahrb. xxxvii. (1906) pp. 576–578.

Malvastrum parnassiæfolium, A. Gray, *β. lobulata*, Wedd., Baker fil. in Journ. Bot. xxix. (1891) p. 171.

PERU: in planitie circa Tissaloma, 4570 m., *Meyen* (Herb. Berol.)!

BOLIVIA: Lagunillas de Potosi à Oruro, *D'Orbigny*, 1355 (Herb. Mus. Paris.)! Prov. Omasuyos, near Guarina and Penas, 4000 m., *Mandon*, 810! Hillsides near Acacache, 3960–4120 m., *A. W. Hill*, 79 (Herb. Kew.)! Vila-acque plateau near La Paz, 4000 m., *R. Hauthal*, 328 (Herb. Berol.)!

Huaynà-Potosi, Franz-Joseph Glacier, 4900–5200 m., *F. Germann*, 15 (Herb. Mus. Hamburg.)!

Under the name *Malva parnassiæfolia*, Weddell includes the variety *β. lobulata*, "crenis foliorum majoribus, lobuliformis," one of the types of which is D'Orbigny's plant from Potosi, Bolivia, which bears the number 1355 and is also the type of *Nototriche incisa*, Turcz. This plant proves to be identical with the type of Walpers's *Sida nubigena*, collected by Meyen near the southern end of Lake Titicaca. Weddell retained the species *Malva nubigena* and placed it in a special section (Chlor. And. ii. p. 276) "Flores involucello destituti," with his *Malva oriastrum*. He, however, suspects that an involucre may be present; and this has been found to be the case in many specimens, though the involucral bracts tend to be either aborted or caducous. *Malvastrum nubigena* is thus properly placed in the genus, and does not occupy the anomalous position to which it was assigned by Weddell. The range of *M. nubigena* is very far removed from that of *M. parnassiæfolium*, and it appears that they are not closely related. The carpels of *M. nubigena* are entirely glabrous and the leaves are deeply lobed. This species shows fairly close affinity with *M. Fiebrigii*, Ulbrich, from S. Bolivia and N. Argentina.

M. nubigena is a somewhat variable species depending on the size and habitat of the individuals. Those collected by Mandon growing in grass have very elongated petioles and peduncles and the leaf-lobulæ are finger-like. The arrangement of the stamens in this species is peculiar. All the free portions of the filaments spring from the staminal tube at the same place and are of about the same length, giving the whole group of stamens the appearance of a small brush.

9. Malvastrum Hauthalii, *E. Ulbrich in Engl. Bot. Jahrb.* xlii. (1908) p. 114.

Bolivia: near La Paz, Palca, Illimani, 4000 m., *R. Hauthal*, 347! 3600–4800 m., *R. Hauthal*, 311 (Herb. Berol.)!

The leaves are deeply and irregularly lobed after the manner of *M. nubigena*, the lobulæ being obtuse or subacute; the whole plant is hairy, the upper surface of the leaves being furnished with scattered hairs, the lower surface densely stellate tomentose. The calyx is covered by a dense felt of long hairs springing from its base, and the involucral bracts are filiform. The rhizome in this species has a thickness of 1·5 cm. in diameter and exceeds 18 cm. in length. In general appearance this species shows resemblance to *M. Englerianum* (*cf.* Ulbrich, *l. c.* p. 115), but differs particularly in the fruit characters: in that species the leaves bear hairs only on the veins and margins and the involucral bracts are broader and fringed with bristles.

10. MALVASTRUM PURDIAEI, *A. Gray in Bot. U.S. Expl. Exp.* p. 150 in adnot.*;* descr. emend. et ampl.—*Fruticulus* depressus; caudex subterraneus, lignosus, crassus, fusiformis. *Folia* rosulata, solo adpressa; petiolus 4–6 cm. longus, plus minusve dense stellato-hirsutus; stipulæ membranaceæ, ovato-oblongæ, acutæ, glabræ, 1·5–2 cm. longæ; lamina ambitu orbiculari-ovata vel pentagona, basi cordata, 3–3·5 cm. longa, 3·5–4·5 cm. lata, glabra vel subglabra, infra nervis palmatis stellato-tomentosis, plus minusve conspicue 3–5-lobata, lobis crenato-dentatis margine ciliatis. *Flores* in capitulum terminalem 3–6-florem congesti, pedunculis 5–7 cm. longis dense stellato-hirsutis; involucrum persistens, prophyllis anguste lanceolatis vel subulatis acutis 4–5 mm. longis membranaceis glabris. *Calyx* 7–8 mm. longus, sub medio 5-lobus, segmentis 5 mm. longis ovato-lanceolatis acutis, extra glaber vel parce hirsutus, segmentis intus et ad margines tomentosis. *Corolla* violacea vel purpurea, circa 1·2 cm. longa; petala obovata, truncata, apice inæqualiter dentata, circa 1 cm. lata, basi in tubum 1 mm. longum coalita, uti staminum tubus basi stellato-tomentosa. *Stamina* numerosa, in caput globosum instructa. *Carpella* circa 12, rotundata, dorso breviter stellato-tomentosa.

COLOMBIA: Batis (Paramo), *W. Purdie*, Sept. 1845 (Herb. Kew.)! Andes orientalis, 2800–3500 m., Herb. *J. J. Triana*, 373 (Herb. Mus. Brit.)!

Malvastrum Purdiaei, A. Gray in Bot. U.S. Expl. Exp. p. 150, in adnot.; non Planch. in Triana et Planch., Prod. Fl. Nov. Granat. p. 154, *Malva Purdiaei*; non Wedd., Chl. And. ii. p. 275, *Malva Purdiaei.*

Malva acaulis, Cav., var. *β. granatensis*, Pl. et Lind., in Triana et Planch., Prod. Fl. Nov. Granat. p. 154, partim.

Malvastrum Purdiaei, A. Gray, non Wedd.; Baker fil. in Journ. Bot. xxix. (1891) p. 171.

Malvastrum acaule, A. Gray; Baker fil. in Journ. Bot. xxix. (1895) p. 171, partim.

Malvastrum Purdiaei, A. Gray, described in Bot. U.S. Expl. Exp. p. 150, in adnot., is a distinct plant from the *Malva Purdiaei*, Planch., described in Triana et Planchon, Prod. Fl. Nov. Granat. p. 154, although they are there regarded as synonymous. According to Gray the peduncles are terminated by a capitate cluster of three flowers, "pedunculis . . . . . . apice capitato-trifloris." The calyx is hairy externally and the carpels are muticous and tomentose. *Malva Purdiaei*, Planch., described from the specimens in Hooker's herbarium, on the other hand, has the peduncles uniformly one-flowered, the calyx is glabrous except in rare cases, and the carpels are beaked. This latter plant must therefore be described as a new species, and the name *Malvastrum purpureum*, A. W. Hill, has been assigned to it (*v.* p. 219).

Further confusion has been introduced into the synonymy of this species owing to the fact that Triana and Planchon have described it as *Malva acaulis*,

Cav., *β. granatensis*, Pl. et Lind., and have been followed by Weddell, who adds other specimens under this varietal name. Baker fil. falls into the same error as Triana & Planchon and Weddell in uniting *Malvastrum Purdiaei*, A. Gray, and *Malva Purdiaei*, Wedd. He appears to have been misled by the somewhat ambiguous arrangement of the 'Chloris Andina' with respect to the geography of species and varieties, and includes specimens assigned to *Malva acaulis, β. granatensis*—which may belong to *Malvastrum Purdiaei*, A. Gray—under *Malvastrum acaule*, A. Gray. For *M. acaule* occurs only in Peru and Bolivia (?) (*v.* p. 230), whereas Venezuela and New Granada are wrongly cited as localities for this species by Baker.

M. Purdiaei, A. Gray, does not appear to be at all closely allied to *M. acaule*, as suggested by Gray in his note on the species.

11. MALVASTRUM MERIDÆ, *A. W. Hill.*—*Fruticulus* depressus; caudex subterraneus. *Folia* rosulata, solo adpressa; petiolus 2–6 cm. longus, subglaber vel parce pilosus; stipulæ membranaceæ, glabræ; lamina ambitu late obovato-orbicularis, basi cuneata, 1·3–3 cm. longa, 1·5–3·5 cm. lata, supra et subtus glabra vel subglabra, aliquando paullo 3–5-lobata, margine crenato-dentata. *Flores* pedunculis 2-floris strigoso-stellato-tomentosis; involucrum persistens, prophyllis 3–4 ovato-lanceolatis 6–9 mm. longis 3 mm. latis integris dentatis vel aliquando lobatis glabris. *Calyx* 7·5–9 mm. longus, sub medio 5-lobus, segmentis 5–6 mm. longis triangulari-ovatis subacutis, extra glaber, segmentis intus et ad margines tomentosis. *Corolla* alba, 1–1·2 cm. longa; petala obovata, unguiculata, 4–6 mm. lata, basi in tubum circa 1 mm. longum coalita, uti staminum tubus basi dense stellato-tomentosa. *Stamina* pauca, in caput globosum instructa. *Carpella* reniformia, dorso sulcata, apice brevi strigoso-stellato-tomentosa (*Moritz*).

Malva acaulis, Cav., *β. granatensis*, Wedd. Chl. And. ii. p. 275, partim (Linden); non Pl. et Lind.

Malvastrum acaule, *β. granatensis*, Baker fil. in Journ. Bot. xxix. (1891) p. 171.

VENEZUELA: Prov. Merida, Paramo de Mucuchies, 3900 m., *Linden*, 1425 (Herb. Kew. et Mus. Brit.)! Paramo de Mucuchies (?), *Moritz* (Herb. Mus. Brit.)!

Linden's plant no. 1425, which has been considered to be the variety *β. granatensis* of *Malva acaulis*, Cav., by Weddell and Baker fil., is not the var. *β. granatensis*, Pl. et Lind. (see *M. Purdiaei*, A. Gray, p. 225). Owing to the confusion which has arisen around this varietal name, it is best to let it fall into disuse and to describe the specimens under a new specific name. *M. Meridæ* shows some resemblance to *M. Purdiaei*, A. Gray; it differs, however, in the scarcely lobed and almost glabrous leaves, cuneate at the base, in the two-flowered peduncles and white flowers.

12. Malvastrum Stuebelii, *Hieron. in Engl. Bot. Jahrb.* xxi. (1895) p. 318.

Peru : near Cajamarca, Monte Altura de Santa Ursula, *Stübel*, 38 (Herb. Berol.) !

This species shows some external resemblance to *M. alismatifolium* in its ovate leaves, but it is quite distinct from this and other species. The large flowers are borne on elongated peduncles and the involucral bracts are ovate-lanceolate. The laminæ have crenate margins and are covered with hairs on the lower, but are glabrous on the upper surface. The calyx is covered with a dense felt of strigose hairs. Hieronymus (*l. c.* p. 318), in comparing this plant with *M. parnassiæfolium*, speaks of the leaves as "supra hirsutis"; they are, however, almost if not quite glabrous above. The affinity suggested between this species and the forms allied to *M. parnassiæfolium* is probably not very close, as the fruits are conspicuously different.

13. Malvastrum crenatum, *A. W. Hill.*—*Fruticulus* depressus ; caudex subterraneus, lignosus, firmus. *Folia* rosulata, solo adpressa ; petiolus 3–5 cm. longus, dense strigoso-tomentosus ; stipulæ lanceolatæ, acutæ, 3–4 mm. longæ, glabræ ; lamina ambitu orbicularis, basi cordata, circa 1·5 cm. longa, 2 cm. lata, supra—præsertim in novellis—plus minusve dense strigoso-ciliata, subtus præsertim in nervis stellato-tomentosa, 5–7-lobata, lobulis crenatis vel subacutis. *Flores* singuli, numerosi, pedunculis 1–2 cm. longis dense ciliatis ; involucrum persistens, prophyllis 3 subulatis 4 mm. longis membranaceis glabris vel parce ciliatis. *Calyx* 5–7 mm. longus, ad medium 5-lobus, glaber, segmentis triangulari-acutis marginibus longe ciliatis intra glabris. *Corolla* alba, 8 mm.–1·2 cm. longa ; petala 1 cm. longa, 6 mm. lata, obovata, irregulariter emarginata, basi in tubum hirsutum circa 2 mm. longum coalita. *Stamina* numerosa, in caput obconicum instructa. *Carpella* matura non visa, rotundata, dorso dense hirsuta.

Malvastrum Richii, Baker fil. in Journ. Bot. xxix. (1891) p. 171, partim, non A. Gray.

Peru : Hacienda Arapa, near Yauli, Lima-Oroya Ry., 4400 m., *Weberbauer*, 360 (Herb. Berol.) ! without precise locality, *Maclean* (Herb. Kew.) !

This species resembles *M. rhizanthum* in the leaf form and in the size of the flowers, but differs especially in the wrinkled and strigosely hairy leaves and in the calyces with their ciliate margins. The Kew specimen of *M. crenatum* has been included by Baker fil. *l. c.* under *M. Richii.*

14. Malvastrum Richii, *A. Gray in Bot. U.S. Expl. Exp.* p. 149.

Malva Richii, Wedd. Chl. And. ii. p. 276.

Malvastrum Richii, A. Gray; Baker fil. in Journ. Bot. xxix. (1891) p. 171, partim.

Peru : near Obrajillo or Banos, *Pickering* (Herb. Gray.) ; Cerro Pasco, sides of hills, *Matthews*, 679 (Herb. Kew.) !

There seems little doubt that the plant in the Kew Herbarium collected by Matthews is the same as that described by Gray. It is distinguished from all the other species in this acaulescent section by the dense covering of stellate hairs to the leaves and calyces. The Kew plant is singular in having no carpels developed and the flowers have stamens only; there is also no description of the female organs given by Gray. This species thus appears to be comparable in this respect to *Nototriche Azorella* and *N. congesta* *.

In general appearance *M. Richii* resembles *M. crenatum* and *M. rhizanthum*, but is easily distinguished by the character and distribution of the tomentum.

15. MALVASTRUM BAKERIANUM, *A. W. Hill.*—*Fruticulus* depressus; caudex subterraneus, lignosus, firmus. *Folia* rosulata, solo adpressa; petiolus 1·5–5 cm. longus, supra præsertim strigoso-hirsutus; stipulæ lineari-lanceolatæ, acutæ, 1–1·5 cm. longæ, margine ciliatæ; lamina ambitu ovata, basi rotundata vel subcordata, 2–3 cm. longa, 2–2·5 cm. lata, supra glabra vel parce hirsuta, subtus ad nervos hirsuta, nervis plus minusve pinnatifidis, aliquando obscure 5-lobata, margine brevi-dentata vel bidentata, ciliata. *Flores* singuli, pedunculis 1–3 cm. longis strigoso-hirsutis; involucrum persistens, prophyllis 1–3 linearibus acutis 8–9 mm. longis margine ciliatis. *Calyx* 1 cm. longus, ad medium 5-lobus, segmentis triangulari-ovatis acutis, extra glaber vel parcissime pilosus, segmentis intus pubescentibus. *Corolla* alba, 2–2·3 cm. longa; petala late obovata, retusa, 1·2 cm. lata, basi in tubum 1·5 mm. longum coalita, uti staminum tubus basi stellato-tomentosa. *Stamina* numerosa, in caput cylindricum densum instructa. *Carpella* matura non visa, dorso hirsuta.

PERU: Dep. Puno, Tirapata, argillaceous fields, 3900 m., *A. W. Hill*, 74 (Herb. Kew.)! Pucara, open meadows, 3700 m., *Weberbauer*, 443 (Herb. Berol.)! Vilcanota, 5340 m., *Pentland* (Herb. Kew.)!

This species shows some resemblance to *Malvastrum acaule*, but differs especially in the ovate leaves, with their rounded or subcordate bases in the single flowers with calyces whose teeth are broader and longer in proportion than those of *M. acaule*. The general appearance of *M. acaule*, with its crowded flowers in the centre of the rosette of long petioled leaves and the texture of the laminæ, differs markedly from *M. Bakerianum*. In *M. acaule* the flowers are stated by Dombey to be yellow, becoming green on drying, while in *M. Bakerianum* the flowers are white. This character is well seen in the Kew specimens.

16. MALVASTRUM ORIASTRUM, *Baker fil. in Journ. Bot.* xxix. (1891) p. 172; descr. emend. et ampl.—*Fruticulus* depressus; caudex subterraneus, lignosus. *Folia* rosulata, solo adpressa; petiolus 2·5–3·5 cm. longus, basi dilatatus, glaber; stipulæ membranaceæ, lanceolatæ, acutæ, plus minusve 1 cm. longæ,

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* *Vide* Hill, A. W.. in Engl. Bot. Jahrb. xxxvii. (1906) p. 582; and Trans. Linn. Soc. ser. 2, Bot. vii. (1909) p. 220.

margine parce ciliatæ ; lamina ambitu plus minusve ovata, acuta, basi subcuneata, 2·5–3 cm. longa, 1·5–2 cm. lata, glabra, nervis pinnatis, profunde vel plus minusve leviter 5–7-pinnatilobata, lobis inæqualiter crenato-dentatis. *Flores* singuli, pedunculis 1–2 cm. longis glabris; involucrum sæpius abortum vel caducum, prophyllis plus minusve 5 mm. longis subulatis margine ciliatis (*Pearce*, Herb. Kew.). *Calyx* 9–10 mm. longus, sub medio 5-lobus, glaber, segmentis 6 mm. longis anguste ovato-lanceolatis acutis intus velutino-tomentosis. *Corolla* alba, 1·7 cm. longa ; petala late obovata, obtusa, 1·5 cm. longa, 1 cm. lata, basi in tubum 2 mm. longum coalita. *Stamina* numerosa, in caput cylindricum instructa. *Carpella* **matura** non visa, apice hirsuta.

Malva oriastrum, Wedd. Chl. And. ii. p, 277.

Bolivia : Prov. Cinti, bare spots on 'punas,' 3500 m., *Weddell*, 3962 (Herb. Mus. Paris.) ! Andes of Ayacucho, 13000–14000 ft. (May 1867), *R. Pearce* (Herb. Kew. et Mus. Brit.) ! ? Without precise locality, *Lobb* ! ? (Herb. Kew.).

M. oriastrum and *M. nubigena* were placed apart by Weddell from the other acaulescent species on account of the supposed absence of an involucre. *M. nubigena*, however, has been found to have an involucre which is often very early caducous. In Weddell's specimens of *M. oriastrum* the involucre appears to have aborted or may never have developed, but in specimens at Kew collected by Pearce, which appear to belong to this species, an involucre is present in some cases. *M. oriastrum* is so nearly related to the other acaulescent species of the genus, that the abortion of the involucre cannot be considered in any way to exclude this species.

17. Malvastrum acaule, *A. Gray in Bot. U.S. Expl. Exp.* p. 150 in adnot. ; descr. emend. et ampl.—*Fruticulus* depressus ; caudex subterraneus, napiformis, crassus, edulis (*Dombey*). *Folia* rosulata, solo adpressa ; petiolus 3–6 cm. longus, plus minusve strigoso-hirsutus; stipulæ membranaceæ, lanceolatæ, acutæ, margine ciliatæ ; lamina ambitu subrotundata vel late ovata, basi truncata vel subcuneata, 2·5–3·2 cm. longa et lata, supra glabra, subtus ad nervos plus minusve hirsuta, minute reticulata, nervis palmatis, 5–7-lobata, lobis inæqualiter et acute denticulata, dentibus apice ciliatis. *Flores* pedunculis 2–4-floris rarius unifloris numerosis, pedicellis 5–10 mm. longis, pedunculis 2–4 cm. longis parce strigoso-hirsutis ; involucrum persistens, prophyllis 2–3 anguste oblongis vel linearibus 6–9 mm. longis acutis margine ciliatis. *Calyx* 7–8 mm. longus, sub medio 5-lobus, segmentis circa 5 mm. longis ovato-lanceolatis acutis extra basi parce setosis intus stellato-tomentosis. *Corolla* flavescens, in sicco viridis, 2–2·5 cm. longa ; petala late obovata, subrotundata, plus minusve 1 cm. lata, basi in tubum circa 1 mm. longum coalita, basi stellato-tomentosa. *Stamina* numerosa, in

caput cylindricum instructa. *Carpella* circa 20, matura non visa, dorso dense stellato-tomentosa.

Malva acaulis, Dombey ex Cav. Diss. ii. p. 82, t. 35. fig. 2; DC. Prodr. i. p. 435; Wedd. Chl. And. ii. p. 274.

Malvastrum acaule, A. Gray, *l. c.* p. 150; Baker fil. in Journ. Bot. xxix. p. 171, partim.

PERU: Cordillera of Central Provinces, without precise locality, *Dombey*, 677 (Herb. Berol.)! Huamantanga, *A. Matthews*, 597! without precise locality, *Maclean* (Herb. Kew.)!

The specimens of *M. acaule* agree very closely with Dombey's description and with the figure given by Cavanilles, except that the peduncles usually appear to be 1- or 2-flowered, though they are described and figured as being sometimes 4-flowered; in the Dombey specimen at the British Museum the majority of the peduncles are 2-flowered. The peduncle appears to split into two, each portion terminating in a flower. The flowers are said to be yellow and to turn green when dry, which is well seen in the Kew specimens. The mass of flowers in the centre of the leaf-rosette is a striking feature of the plant. It is unfortunate that the exact habitat of this interesting species is very imperfectly known; it appears, however, that its home must be in the Cordillera above Lima, judging from the names of the collectors. With regard to the variety of this species which has been described under the name β. *granatensis* from Ecuador and Venezuela, it appears that a mistake has been made and that not only are there two distinct forms to which this name has been given (*M. Purdiaei*, A. Gray, and *M. Meridæ*, A. W. Hill), but also that neither of them is a variety of *M. acaule*. A further slight confusion has been caused owing to the citation by Baker fil. (*l. c.*) of all the localities given by Weddell for *M. acaule* and its supposed variety under the species *M. acaule*. With regard to the locality in Bolivia quoted by Weddell and Baker fil. under *M. acaule* for D'Orbigny's specimen from Alto de Lagunillas, some uncertainty exists, and it may be that this plant* has been wrongly referred to *M. acaule*.

18. MALVASTRUM ENGLERIANUM, *E. Ulbrich in Engl. Bot. Jahrb.* xlii. (1908) p. 115.

PERU: Dep. Ancachs, Prov. Cajatambo, between Tallenga and Piscapaccha, 3800–4000 m., *Weberbauer*, 2888!

The flowers are large and conspicuous and the calyx-teeth acuminate. The involucral bracts like the calyx, petioles, etc., are furnished with coarse hairs. The leaves are glabrous above but bear hairs on the margins and on the veins on the lower surface. *M. Weberbaueri* resembles this species in external characters but differs in the characters of the fruits, tomentum, and sulphur-yellow flowers which are smaller than those of *M. Englerianum*.

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* M. Lecomte informs me that no trace of this specimen can be found at Paris.

The TRIUMFETTAS of Africa.

By T. A. SPRAGUE, B.Sc., F.L.S., and J. HUTCHINSON.

(PLATE 17.)

[Read 17th June, 1909.]

OUR attention was directed to the genus *Triumfetta* by the great difficulty experienced in determining the new African material which was received from time to time at the Kew Herbarium; and in order to overcome this difficulty, a provisional arrangement of the African species was drawn up some years ago. The nature of the fruit was taken as the basis of classification, as affording easily ascertainable and, in the majority of the species, highly constant characters; and further study has shown the choice to have been a happy one. The importance of the characters derived from the fruit was appreciated to some extent by Masters in 1868, when he described the 15 species then known from Tropical Africa (Fl. Trop. Afr. i. 254), but it has not always been realized: thus Schumann wrote that it was extremely difficult to distinguish the species, owing to the polymorphy of the leaves and fruits (Mart. Fl. Bras. xii. III. 131). In dealing with the African Triumfettas, however, we have found none except *T. heterocarpa* of which it could be said that the fruits are polymorphic, although in a few, such as *T. cordifolia*, the indumentum and size of the fruit appear to be subject to considerable variation.

The scope of the paper as originally planned was limited to the species found on the continent of Africa, but it was afterwards found desirable for purposes of comparison to include those of the African islands in the widest sense. In our area, as thus extended, all the more important groups of *Triumfetta* are represented, and the classification we propose, while designed primarily for the African species, is therefore applicable to the genus as a whole.

Previous authors, from A. P. De Candolle to Baillon, have recognized two sections of the genus, based respectively on *Triumfetta*, L., and *Bartramia*, L., as redefined by Gaertner in 1791 (Fruct. ii. 137, t. 111). Linnæus (Gen. Pl. ed. 5, 203) distinguished *Triumfetta* from *Bartramia* by the absence of a calyx [corolla]; and Gaertner added that the fruit of *Triumfetta* was indivisible, with 1-seeded cells, whereas that of *Bartramia* was divisible into 2-seeded cocci.

In 1824, A. P. De Candolle (Prodr. i. 506) recognized two sections of *Triumfetta* as follows :—

I. LAPPULA, DC. (=*Triumfetta,* Gaertn.). Petals wanting ; fruit indivisible.

II. BARTRAMEA, DC. (=*Bartramia,* Gaertn.). Petals present; fruits divisible.

Endlicher in 1840 (Gen. Plant. 1008) and Masters in 1868 (Fl. Trop. Afr. i. 254) adopted De Candolle's sections, defining them entirely by the fruit characters: LAPPULA, with indehiscent fruit; and BARTRAMEA, with dehiscent fruit. Baillon in 1873 (Hist. Pl. iv. 195) replaced the name *Lappula* by *Eutriumfetta,* still distinguishing it from *Bartramia* (sic) by the indehiscent fruit. Finally, in 1886, K. Schumann (Mart. Fl. Bras. xii. III. 131) rejected the characters derived from the fruit, and defined the two sections as follows :—

EUTRIUMFETTA. Petals absent; gonophore very short, without glands.
BARTRAMIA. Petals present; gonophore with 5 glands.

Schumann's sections are clearly unnatural, since they involve the separation of two such closely allied species as *T. Lappula* and *T. semitriloba,* of which Linnæus remarked in 1767, "*T. Lappulæ* calyx nullus . . . ., at *T. semitrilobæ,* Jacq., calyx perfectus . . . .; utrasque simillimas distinguere an specie liceat?" (Gen. Pl. ed. 6, 239). Apart from the great reduction in the flower, there is very little to distinguish *T. Lappula* from *T. semitriloba*; and when it is considered that in *T. pentandra,* Rich., a series of intermediates has been found between flowers with 13 stamens and a well-developed ciliate disc and others with only 5 stamens and hardly a vestige of the disc, there can be no doubt that *T. semitriloba* and *T. Lappula* are very nearly related.

Nor does a primary division between the species with dehiscent and those with indehiscent fruits give satisfactory results. The texture of the fruit, however, and the nature of the prickles or bristles which it bears, yield excellent characters, which, associated with others derived from the inflorescence and the indumentum of the sepals, have enabled us to divide the genus into four apparently natural sections.

In the simplest type of inflorescence the cymes are solitary at the nodes and are opposite the leaves, the branching being sympodial. This and its modifications are characteristic of two of our proposed sections, *Porpa* and *Lasiothrix.* In a more complex type, described by K. Schumann (Engl. u. Prantl, Nat. Pflanz. iii. VI. 10), several (two or more) cymes are borne at each node, the primary one being opposite the leaf, and the remainder arising on one side of the stem between the insertion of the leaf and the primary cyme. This type is characteristic of the sections *Lepidocalyx* and *Lappula.*

Lepidocalyx differs from the other three sections in the calyx, which has a dense covering of peltate scales resembling those of the Eælagnaceæ.

Both *Porpa* and *Lepidocalyx* have hard, woody, several-seeded fruits: the fruits of *Porpa* (Pl. **17.** f. 6) are covered by prickles, which are gradually narrowed from the base to the apex; whereas those of *Lepidocalyx* (Pl. **17.** f. 1) have a covering of spindle-shaped tubercles, which are polygonal in section at their broadest part, where they fit closely together.

The fruits of *Lasiothrix* (Pl. **17.** ff. 2–3), on the other hand, are very light, indehiscent and usually one-seeded, and are covered with numerous plumose bristles; whilst those of *Lappula* (Pl. **17.** ff. 4–5, 7–12) are either dehiscent or indehiscent, and are covered with comparatively rigid prickles.

The sections may be defined as follows:—

I. Lepidocalyx, nob., sect. nov.

Calyx extus lepidotus. Stamina numerosa (25–60). Ovarium 10-loculare, loculis uniovulatis. Fructus globosi, lignosi, 8–10-loculares, loculis monospermis, tuberculis fusiformibus obtecti.—Frutices vel suffrutices, erecti vel procumbentes, cymis ad nodos vel binis, primaria oppositifolia, altera inter cymam primariam et petiolum orta, vel pluribus.

Species 2, Africæ tropicæ incolæ.

II. Porpa, nob., sect. nov.

Calyx non lepidotus. Stamina numerosa (25–40). Ovarium 6–10-loculare, loculis uniovulatis. Fructus globosi, lignosi, 6–10-loculares, loculis monospermis, aculeis e basi ad apicem attenuatis obtecti.—Plantæ procumbentes, radicantes, cymis ad nodos solitariis oppositifoliis.—*Porpa,* Blume, Bijdr. 177 (1825), genus.

Species 2, insularum Oceani indici, Malayæ, Australiæ Polynesiæque incolæ.

III. Lasiothrix, nob., sect. nov.

Calyx non lepidotus. Stamina sæpius numerosa (20–50), rarius pauca. Fructus globosi, non lignosi, perleves, indehiscentes, sæpius monospermi, setis debilibus plumosis obtecti.—Frutices suffrutices vel herbæ, erecti vel procumbentes, plerumque rhizomate lignoso, cymis ad nodos solitariis oppositifoliis et interdum ramos terminantibus.

how many loculi?

3-6-loculi

Species 16, quorum 13 Africanæ, 3 Australianæ.

IV. Lappula, DC., sensu ampl.

Calyx non lepidotus. Stamina numerosa vel pauca. Fructus globosi vel ovoidei, non lignosi, dehiscentes vel indehiscentes, pleiospermi vel monospermi, aculeis satis rigidis (rarissime setis plumosis) obtecti.—Frutices, suffrutices vel herbæ, erecti, scandentes vel procumbentes, cymis ad nodos pluribus, primaria oppositifolia, reliquis inter cymam primariam et petiolum ortis.—*Lappula* et *Bartramea*, DC. Prodr. i. 506 (1824).

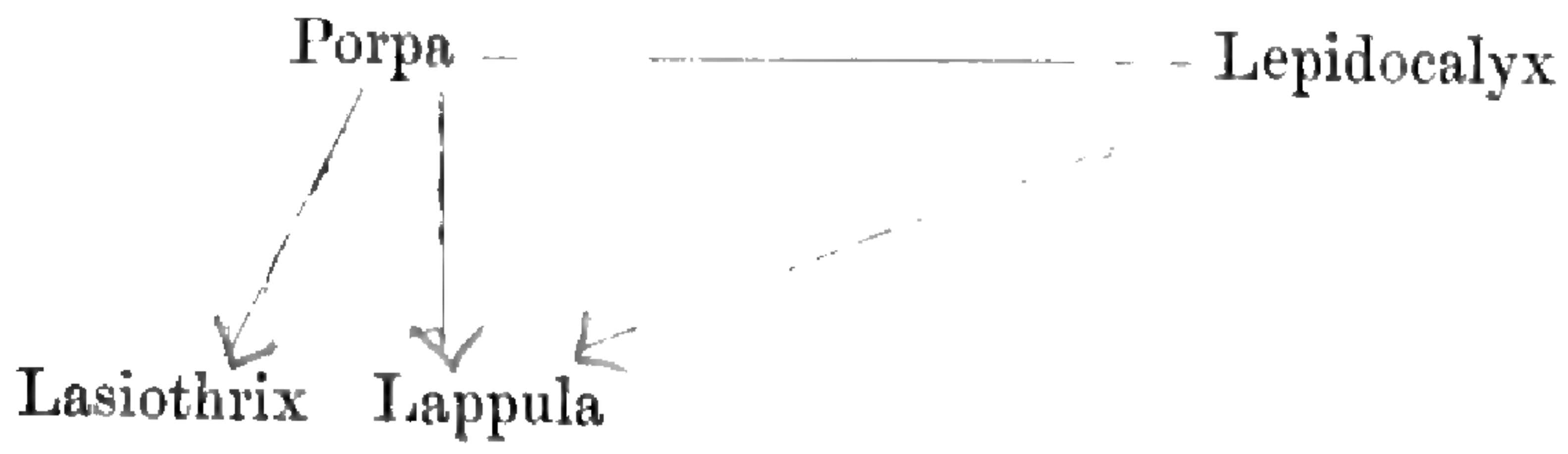
Species circiter 90, regionum calidiorum utriusque orbis incolæ.

Before discussing the relative antiquity of the sections it will be convenient to state what characters we regard as primitive in *Triumfetta*.

1. Those commonly found in the Malvales or in Tiliaceæ: such are stellate hairs, palmate venation of the leaves, numerous stamens, and a several-celled ovary and fruit, relatively to simple hairs, pinnate venation, few stamens, and a 1–2-celled ovary and fruit.
2. Those common to *Triumfetta* and certain other genera of Tiliaceæ: such are the subapical horns of the sepals, and the gonophore.
3. A simple or little specialized as opposed to a complex or highly specialized inflorescence or fruit.
4. Fruticose or suffruticose relatively to herbaceous habit.

Further, we hold that a group with few, well-defined species may, *ceteris paribus*, be regarded as older than one including many ill-defined species; also that a group with discontinuous distribution and species of restricted area may be held to be older than one with continuous distribution and widely spread species.

Our ideas as to the relations between the four sections may be represented graphically as follows:—



On the top line are *Porpa* and *Lepidocalyx*, sections including only 2 species each, with numerous stamens and woody several-celled fruits. *Porpa* with simple inflorescence appears to represent a primitive type; whilst *Lepidocalyx*, which may be regarded as highly archaic on account of the scaly calyx and spindle-shaped tubercles, presents in its inflorescence a type approaching to that of *Lappula*.

Porpa and *Lasiothrix* on the left, and *Lepidocalyx* and *Lappula* on the right, have respectively a single cyme, and two or more cymes at each node. On the bottom line are *Lasiothrix* with 16 species, and *Lappula* with about 90 species. In both the inflorescence is on the whole more modified, although of the same general type as in *Porpa* and *Lepidocalyx* respectively; in both, besides species with numerous stamens, there are others with 10–12 stamens or fewer; and in both, the fruit shows special modifications for distribution.

For these reasons we regard *Lasiothrix* and *Lappula* as more modern types than *Porpa* and *Lepidocalyx*; and *Lappula* as more modern than *Lasiothrix*.

Before considering the sections in detail, it may be well to give some particulars of the structure of the flower and fruit, which are not generally found in descriptions of the genus. The flowers are normally pentamerous as to the calyx and corolla, but tetramerous and hexamerous flowers may also occur. The petals are hairy towards the base, the claw being ciliate, sometimes hairy on the outside, and sometimes with a transverse line of hairs on the inner surface shortly above the base. Above the insertion of the petals comes an androgynophore or gonophore, with a quadrangular or rounded, glandular patch above each petal. The gonophore is produced above into a more or less membranous (in a dried state), ciliate ring or disc, within which the stamens are inserted. The filaments show transverse file-like markings. The ovary is tubercled, each tubercle being terminated by one or more stiff hairs, which eventually develop into rigid spinules in most cases. For convenience of description, they are hereafter termed "spinules" whatever their degree of rigidity. There are 2–5 cells in the ovary, each containing 2 pendulous, collateral ovules, but there is a widespread tendency to more or less complete division by longitudinal false septa into twice as many 1-ovuled cells. Thus in *Lepidocalyx* the ovary is completely 10-celled.

As regards the dehiscence of the fruit it is often difficult to speak with certainty. In some species, e. g. *T. annua*, the fruits dehisce readily; in others, such as *T. Welwitschii* and *T. flavescens*, they are quite indehiscent; but in a third set, though the fruit can be separated after boiling into separate valves ("capsula partibilis" of Gaertner), there is no evidence to show that it does actually dehisce. *T. rhomboidea* is a good example.

Among the characters which we have found useful in distinguishing the species and groups of higher rank are the following:—

1. Habit: this is usually characteristic of the higher groups, more rarely of single species. Occasionally, however, it varies in the same species: thus *scandens* and *macrophylla* var. *ruwenzoriensis* are both said to be sometimes erect shrubs, and sometimes climbers, according to situation.

2. Indumentum of the stem and leaves: this requires to be used with great caution. While it is characteristic of certain species such as *actinocarpa*, *Sonderii*, *Dekindtiana*, *annua*, and *eriophlebia*, it serves in many instances only for the distinction of varieties, as in *cordifolia*, *pilosa*, and *macrophylla*. The nature of the indumentum often changes in the course of development of the leaves: thus the young leaves may be covered with both stellate and simple hairs, whilst the adult leaves of the same species may have hairs of one kind only. The indumentum of the flower-buds is generally about of equal value, but that of the fruits is much more constant, most of the species having fruits either constantly glabrous or constantly pilose. Among the exceptions are *cordifolia* and *annua*.

3. The lobing of the leaves affords useful characters: a few species, such as *Kirkii*, have the leaves always lobed, and a great many have them constantly undivided; whilst in others, such as *macrophylla* and *effusa*, the uppermost leaves are commonly undivided and the lower ones lobed.

4. The shape of the flower-buds and sepals and the nature of the horns are highly important. The length of the buds is also useful, but care is needed to select fully grown buds for comparison.

5. The petals as a rule do not give characters of any value, except in regard to the disposition of the pubescence on the claw.

6. The length of the gonophore and the shape of the glands, and whether the latter are contiguous or distant.

7. The ciliate disc shows but little variation. In *T. pentandra* it may be present or obsolete, and in *T. Lappula* it is absent.

8. The number of stamens is generally of great importance: certain groups have 20 or more; *rhomboidea* and *eriophlebia* have 15; and a great many species have 10–12. A smaller number is rare: *pentandra*, however, may have as few as 5, and the recently described *triandra* (Kew Bull. 1909, 258) has only 3. The greatest amount of variability is shown in *macrophylla*, which may have from 12 to 25 stamens.

9. The number of ovary-cells is a good specific character in the section *Lasiothrix*, but it is generally of less importance in the other sections. Where the ovary is too small to admit of being easily dissected, the number of stigmas may be ascertained by opening a young bud. At a later stage the stigmas are closely pressed together and difficult to separate without application of reagents.

10. The shape of the fruit is usually constant for a given species, the most general form being globose or subglobose. Ovoid fruits occur in *flavescens* and *pentandra*, and a trigonous-ovoid fruit in *trigona*. *T. benguelensis* is particularly interesting, as producing both globose, 3-celled fruits and ovoid, 1–2-celled fruits. The globose form is obviously the more primitive.

11. The size of the fruit appears to be a good specific character in many cases, but its practical value in herbarium work is lessened by the difficulty of determining from dried material whether the fruits are ripe or not.

12. While the general nature of the appendages of the fruit (tubercles, bristles or prickles) yields sectional characters, the details are often characteristic of individual species. The number and shape of the terminal spinules are particularly important.

The delimitation of the species offers no difficulty in certain groups, but in others it is extremely difficult to draw the line between two or more allied species: thus in *Lepidocalyx*, *Porpa*, and *Lasiothrix* (excluding the subsection *Paniculatæ*) the species are well-marked, and may be distinguished from their neighbours by one or more striking characters; but in *Lasiothrix*, subsect. *Paniculatæ*, and frequently in *Lappula* they appear to be connected by numerous intermediate forms, which almost defy classification in the herbarium. The difficulty is enhanced by the incomplete nature of much of the material, identification being frequently uncertain in the absence of fruits. It is possible that some of the intermediate forms referred to may be hybrids, but there is no evidence of this. A satisfactory classification of the more critical species is probably unattainable without special work in the field.

It seems desirable to summarize what little is known of the ecology of the African species. Most of them are shrubs, undershrubs, or perennial herbs, comparatively few being annuals. Among the latter is *annua*, which is a common weed of cultivated land. Most of the shrubby species are erect, but some, such as *scandens*, *cordifolia* var. *Hollandii*, and *macrophylla*, may become climbers when growing in dense forest. The sharp tubercles on the stem of *scandens*, which is the most pronounced climber, have apparently been developed *pari passu* with the adoption of a climbing habit, as they do not occur on the stems of its nearest allies.

As a rule, the species of one natural group belong to much the same ecologic type. *T. procumbens* and *repens* both have long procumbent rooting branches, and are characteristic plants of the Pescapræ formation of the Indo-Malayan seashore (Schimper, Indo-mal. Strandfl. 78). The whole section *Lasiothrix* inhabits dry open country, adapted for the dispersal by the wind of its light plumose fruits; and the species belonging to the subsections are adapted to the conditions of the desert, savannah, or veld in which they grow, either by their shrubby habit, as in the *Actinocarpæ*, or by suffrutescent habit and a woody rhizome, as in the *Digitatæ* and *Sonderianæ*, or by the development of a woody rhizome bearing annual above-ground shoots, as in the *Paniculatæ*.

Many species occur in bushy places, or in clearings or sunny borders of woods, and some of these show a fair amount of adaptability to the surrounding conditions: thus *tomentosa* has been recorded from among bracken and in open grassy places, from the borders of woods and from forest; and *cordifolia* (*typica*) from open places, woods, and forest.

Many of the species appear to be represented only by scattered plants, whilst others, such as *effusa*, may occur in clumps. *T. tomentosa* and *macrophylla* are both locally abundant, being among the commonest constituents of the bush at Marangu, German East Africa, according to Volkens. Finally, *flavescens*, which appears generally to occur scattered, constitutes a distinct formation on the north-east end of Kidero Mt., German East Africa, where it is a bush 1 m. high, according to Jaeger.

As regards pollination, but little is known. From observations by Schimper at Dschadscha, Abyssinia, it appears that the flowers of *flavescens* are visited by inumerable bees; and Scheffler noticed that they were much visited by a small beetle in British East Africa.

Volkens observed that the honey of *macrophylla* and *tomentosa* was assiduously collected by honey-suckers (*Nectarinia*) at Marangu, German East Africa, and states that the same is the case with all the other species of *Triumfetta*.

The flowers of *flavescens* open about 3 o'clock in the afternoon, according to Schimper, and those of *macrophylla* towards evening, on the authority of Volkens. It is probable that the flowers of other species of *Triumfetta* open late in the day, as well-expanded flowers are comparatively rare in the herbarium material of a good many species. This might be due, however, to the specimens having been collected some time before being pressed.

The method of distribution of the fruits appears to be characteristic of at least two of the sections. In the case of *Lasiothrix* there is no direct evidence as to the dispersal of the fruits, but taking into account the extreme lightness of the fruit, the reduction to a single seed, and the great development of weak plumose bristles, there can be little doubt that the fruits are distributed by the wind.

As to *Lappula*, there is no doubt. As early as 1763, Jacquin records that the French people of Martinique called *T. rhomboidea* "Cousin" because the fruits stuck to the clothes of pedestrians (Sel. Stirp. Am. Hist. 147); and the fruits of numerous other species have also been observed to act as burs. The hooked prickles so frequently found in section *Lappula* seem to be exceedingly efficient, and those terminating in a straight spinule or a bunch of spinules much less so.

As to *Porpa*, the great abundance and wide distribution of *T. procumbens* seem to imply some highly efficient method of distribution, but as to what it is we are in doubt. According to Guppy (Plant Dispersal, 42) the fruits of *procumbens* possess little or no floating power. He suggests that they might be transported in birds' plumage.

The sections may now be considered in detail. As to *Lepidocalyx* and *Porpa*, there is little to add. Each contains only a pair of species, separated by well-marked characters.

The following subsections of *Lasiothrix* may be distinguished:—Graciles, Digitatæ, Actinocarpæ, Sonderianæ, Paniculatæ.

Subsect. Graciles is based on a single species, *Kirkii*, which combines slender procumbent stems, palmatifid leaves, few-flowered cymes, borne opposite an ordinary (*i. e.* not reduced) foliage-leaf, strongly cucullate sepals with very short horns, 12 stamens and a 3-celled ovary.

Subsect. Digitatæ includes *digitata*, *macrocoma*, and *trifida*, rhizomatous undershrubs with digitate, 3–5-partite, or trilobed leaves, cymes arranged in a leafy panicle owing to the reduction of the leaves of the ultimate vegetative branches to bracts, sepals usually with well-marked horns, and 25–40 stamens; *digitata* has a 5–6-celled ovary, *trifida* a 3-celled, and *macrocoma* a 2-celled.

Subsect. ACTINOCARPÆ includes *actinocarpa*, *pleiacantha*, and *ramosa* (Kew Bull. 1909, 257), shrubs with suborbicular or elliptic-ovate leaves, few-flowered cymes borne opposite an ordinary foliage-leaf, 35–40 stamens (unknown in *ramosa*) and a 2- or 3-celled ovary.

Subsect. SONDERIANÆ includes *Sonderii*, *plumigera*, and *triandra*, rhizomatous undershrubs with oblong leaves; the cymes are borne on short lateral axillary branches: in *Sonderii* the upper leaves of these branches are reduced to bracts; in *plumigera* all the leaves of the lateral branches are reduced, so that the inflorescences appear axillary; and in *triandra* the lateral branches themselves are so reduced that the cymes appear to be fascicled in the axils of the leaves on the main stems. The stamens are 15–20 in *Sonderii*, 10 in *plumigera*, and 3 in *triandra* (Kew Bull. 1909, 258).

Subsect. PANICULATÆ includes *geoides*, *rhodoneura*, *iomalla*, *hirsuta*, *Mastersii*, and *Welwitschii*, perennial herbs, with thick woody rhizome and annual above-ground shoots, cymes arranged in a terminal leafless panicle owing to the reduction to small bracts of all the upper leaves, 20–53 stamens, and a 2-celled ovary (2–4-celled in *T. Welwitschii*, var. *laxiflora*).

The subsections *Actinocarpæ* and *Sonderianæ* include species both from N. Australia and Africa, and present an interesting phytogeographical problem. The subject is too wide to be discussed in a taxonomic paper, and we will only remark that these two subsections represent a distinctly austral element.

The simplest type of inflorescence is found in the *Graciles* and *Actinocarpæ*, in which none of the foliage-leaves are reduced to bracts; in the *Digitatæ* and *Sonderianæ* the leaves of the axillary branchlets are more or less reduced; and in the *Paniculatæ* all the leaves on axes of various orders in the upper part of the stem are reduced to bracts, a leafless terminal panicle resulting. The first four subsections include fruticose and suffruticose species, and the fifth perennial herbs. The subsection *Paniculatæ* would appear, therefore, to be more highly modified than the other four, and it is noteworthy in this connection that it is the largest subsection and the only one in which the species are critical. It may be subdivided into two groups, the first, including *geoides* and *rhodoneura*, with suborbicular leaves, and the second with more or less oblong or linear leaves. In the latter group the leaves are frequently not fully developed at the time of flowering, and material at this stage may be almost impossible to name. Two of the species, *iomalla* and *hirsuta*, may be distinguished by their indumentum; but the remaining six, namely *Welwitschii*, *Rehmannii*, *laxiflora*, *Descampsii*, *Mastersii*, *heliocarpa*, are exceedingly critical. It is possible that when more ample material comes to hand they will be found to form a complete chain in the order mentioned; in the meantime the first three, which have narrow leaves, are grouped together under a single species, *Welwitschii*, and the last three, with broader leaves, under *Mastersii*.

All the species of *Lappula* with the exception of *T. Dekindtiana* are characterized by a bur-like fruit. The fruit of *T. Dekindtiana* outwardly resembles that of *Lasiothrix*, being covered with rather weak plumose bristles, but it is 4-celled, with 2 seeds in each cell, just as in *micrantha* and *setulosa*, and the inflorescence is of the *Lappula* type. Observations in the field as to the dispersal of its fruits would be of great interest, as it appears to be the only species of *Lappula* in which the fruits are adapted for distribution by the wind.

For practical purposes, three series of species may be distinguished in section *Lappula*. The *Stellatæ* have the prickles terminated by several spinules stellately arranged; the *Geniculatæ* by a single straight spinule inserted at an angle and thus forming a knee with the prickle; and the *Uncinatæ* by a hooked spinule.

These series, though very useful for the purposes of a clavis, do not coincide with natural groups, but appear to represent three of the phylogenetic stages through which many species of *Lappula* have passed, the stellate arrangement being the most primitive and the uncinate the most highly modified.

The following considerations are in favour of this hypothesis:—

1. In the sections which are apparently the more primitive, namely *Lepidocalyx*, *Porpa*, and *Lasiothrix*, only the stellate and geniculate conditions are found.

2. Some species appear to be in a state of transition. The most striking case is that of *heterocarpa*, in which some of the prickles may be of the stellate type, others geniculate and others uncinate. In *flavescens* the stellate and geniculate conditions occur, either on separate fruits or on the same fruit. In *setulosa* and most of the allied species the prickles are usually of the stellate type, but a few geniculate prickles commonly occur among the others. In *tomentosa* the prickles are usually geniculate, but those of Angola specimens are subuncinate. Finally, in *trichocarpa* (type) the prickles are uncinate, but a specimen collected in the Chari Region has some of the prickles stellate and others geniculate, none of them being uncinate.

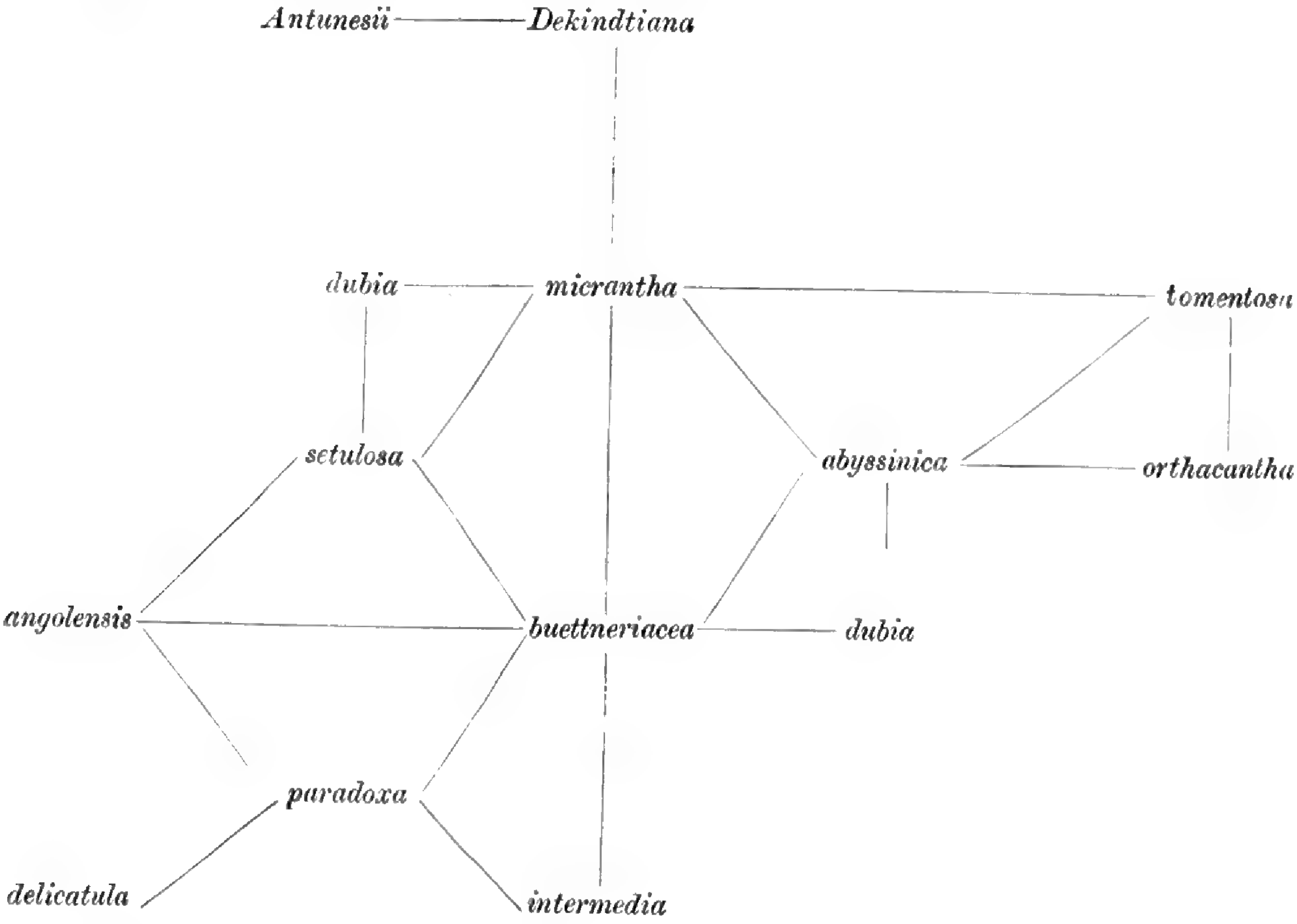
3. Certain closely allied species have prickles of different type. Thus *abyssinica*, with geniculate prickles, is allied to *micrantha*, *buettneriacea*, and *dubia*, which have stellate prickles; and *Antunesii* and *delicatula* with uncinate prickles are undoubtedly closely related to *Dekindtiana* and *paradoxa* respectively, in which the prickles are stellate.

4. As to the sequence of the types of prickle, the reduction from stellate to geniculate is much more probable than the reverse, and it is highly improbable that the uncinate type, which is so efficient in bringing about the

distribution of the fruits by animals, should have given rise to the geniculate instead of *vice versa*.

As it is obviously undesirable to propose subsections of *Lappula* without taking the numerous extra-African species into consideration, it seems best to indicate the principal African groups, one of which may be illustrated by means of a diagram. This group of species includes *setulosa* and its allies. *T. Antunesii* and *delicatula* have uncinate prickles, *tomentosa*, *abyssinica*, and *orthacantha* geniculate, and the remaining species stellate prickles.

The diagram serves also to indicate what species may be confused one with another.



The species allied to *flavescens* form a much better marked group: they are *trigona*, *benguelensis*, *heterocarpa*, and two Indian ones, *glabra* and *rotundifolia*. All are characterized by a more or less spike-like inflorescence, 20 or more stamens, and globose or ovoid, indehiscent fruits.

T. rhomboidea, *eriophlebia*, and *pentandra* come near the *flavescens* group, but the inflorescence is not spike-like, and the stamens are 15 or fewer.

T. semitriloba and *Lappula* belong to an American group, characterized by retrorsely pilose prickles, and probably neither of them is truly indigenous in our region.

The most critical group of all is that which includes *scandens*, *cordifolia*, *macrophylla*, *tomentosa*, *pilosa*, and *effusa*; and it has been found almost impossible to key these species satisfactorily.

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Clavis specierum.

- Sepala extra lepidota.
  - Stamina circiter 60; ovarii tuberculi pilosi, setis pluribus terminati. 1. *lepidota.*
  - Stamina circiter 25; ovarii tuberculi minute glandulosi, spinula unica terminati .... 2. *amuletum.*
- Sepala non lepidota.
  - Fructus lignosi, septis falsis 6–10-loculares, loculis monospermis; plantæ litorales caulibus procumbentibus radicantibus cymis solitariis oppositifoliis.
    - Fructus glabri .... 3. *repens.*
    - Fructus pilosi .... 4. *procumbens.*
  - Fructus non lignosi.
    - Fructus indehiscentes, setis debilibus plumosis muniti; cymæ in nodis solitariæ.
      - Caules procumbentes, gracillimi, multiramosi, foliis palmatifidis .... 5. *Kirkii.*
      - Caules erecti vel, si decumbentes, folia non palmatifida.
        - Frutices vel suffrutices.
          - Folia digitata vel triloba.
            - Folia digitata vel profunde partita.
              - Foliola vel segmenta oblanceolata; ovarium 5–6-loculare .... 6. *digitata.*
              - Foliola vel segmenta lanceolata; ovarium 2-loculare. 7. *macrocoma.*
            - Folia triloba .... 8. *trifida.*
          - Folia indivisa.
            - Frutices foliis suborbicularibus tomentellis.
              - Ovarii setæ spinula unica terminatæ .... 9. *actinocarpa.*
              - Ovarii setæ spinulis pluribus terminatæ .... 10. *pleiacantha.*
            - Suffrutices foliis oblongis vel ellipticis hispidulis .... 11. *Sonderii.*
        - Herbæ caulibus annuis e rhizomate ortis, inflorescentia terminali paniculata.
          - Folia suborbicularia, basi cordata.
            - Folia subtus tantum tomentosa .... 12. *geoides.*
            - Folia utrinque tomentosa.......... 13. *rhodoneura.*
          - Folia linearia, lanceolata, oblonga vel elliptica.
            - Tota planta grosse ferrugineo-tomentosa .... 14. *iomalla.*
            - Plantæ non ferrugineo-tomentosæ.
              - Folia pilis simplicibus et stellatis hirsuta .... 15. *hirsuta.*
              - Folia non hirsuta; pili stellati.
                - Folia adulta 2–4-plo longiora quam lata .... 16. *Mastersii.*
                - Folia adulta 6–8-plo longiora quam lata .... 17. *Welwitschii.*

- Fructus dehiscentes vel indehiscentes, aculeis satis rigidis muniti (in *T. Dekindtiana* tantum setis debilibus plumosis); cymæ in nodis plures.
  - Aculei (vel setæ) spinulis pluribus stellatim dispositis terminati; fructus globosi.
    - Fructus setis plumosis muniti; folia utrinque tomentella .. 18. *Dekindtiana.*
    - Fructus aculeis satis rigidis muniti; folia supra non tomentella.
      - Folia subtus tomentosa, saltem juvenilia.
        - Aculei densiuscule pilosi.
          - Folia lanceolato-oblonga, supra scabrida pilis paucis inconspicuis .... 20. *micrantha.*
          - Folia lanceolata, supra pilis numerosis appressis hirsuta.
            - Sepala extra sparse inconspicue pilosa .... 21. *setulosa.*
            - Sepala extra conspicue fulvo-pilosa .... 27. *dubia*, var. *tomentosa.*
        - Aculei glabriusculi .... 21. *setulosa*, var. *Gilletii.*
      - Folia subtus non tomentosa.
        - Aculei glabri vel pilis brevibus inconspicuis induti.
          - Sepala extra stellato-pubescentia .... 26. *buettneriacea.*
          - Sepala extra inferne glabra.
            - Caules pilis longis simplicibus hirsuti, et aliis minoribus stellatis induti; folia ovata usque lanceolata .... 23. *paradoxa.*
            - Caules pilis plerumque stellatis pubescentes; folia anguste lanceolata .... 25. *intermedia.*
        - Aculei manifeste pilosi.
          - Planta usque ad 1·3 m. alta, superne ramosa; folia supra pilis plerumque simplicibus induta ...... 27. *dubia.*
          - Planta usque ad 0·8 m. alta, e basi ramosa; folia supra pilis plerumque stellatis induta .... 22. *angolensis.*
  - Aculei alii spinulis pluribus, alii spinula unica recta terminati; caules et folia pilis longis simplicibus sparse induti ...... 44. *trichocarpa*, var. *heteracantha.*
  - Aculei spinula unica recta terminati.
    - Frutices erecti.
      - Folia plerumque lanceolata, pubescentia.
        - Fructus pallidi, dense pilosi .... 28. *abyssinica.*
        - Fructus brunnei, parce pilosi .... 29. *orthacantha.*
      - Folia plerumque ovata, tomentosa.
        - Aculei graciles, inferne tantum dilatati.............. 30. *tomentosa.*
        - Aculei validi, e medio in basin valde dilatati .... 31. *Heudelotii.*
    - Herbæ caulibus prostratis.
      - Sepala extra stellato-pubescentia; cornua obtusa ...... 33. *obtusicornis.*
      - Sepala extra sparse setulosa; cornua setula rigida terminata .... 32. *glechomoides.*
  - Aculei spinula unica uncinata vel falcata terminati (si spinuli plures, fructus indehiscentes); fructus globosi vel ovoidei.
    - Aculei retrorse pilosi.
      - Petala, glandulæ gonophori, annulus ciliatus adsunt.... 34. *semitriloba.*
      - Petala, glandulæ, annulus desunt .... 35. *Lappula.*

- Aculei patule pilosi vel glabri.
  - Fructus ovoidei vel globosi, indehiscentes, 4–10 mm. diametro aculeis inclusis; alabastra crassiuscula.
    - Stamina 20–33; inflorescentia spiciformis.
      - Alabastra matura tomentosa vel tomentella.
        - Fructus trigono-ovoidei .... 37. *trigona.*
        - Fructus subglobosi vel ovoidei, non trigoni.
          - Fructus omnes ovoidei; aculei ascendentes, pubescentes, spinula unica falcata vel pluribus terminati; folia supra tomentosa vel pubescentia .... 36. *flavescens.*
          - Fructus subglobosi vel ovoidei; aculei patuli, puberuli, spinula unica uncinata terminati; folia supra scabrido-pubescentia puberula vel glabriuscula .... 39. *heterocarpa*, var. *rodriguesiana.*
          - Fructus globosi vel ovoidei; aculei patuli, superne fere glabri, spinula unica uncinata terminati; folia supra tomentella .... 38. *benguelensis.*
      - Alabastra matura sparse pubescentia vel glabriuscula.
        - Aculei pubescentes, spinula unica uncinata vel falcata vel pluribus terminati; folia supra scabrido-pubescentia vel puberula; alabastra matura sparse pubescentia .... 39. *heterocarpa.*
        - Aculei glabriusculi, spinula unica uncinata terminati; folia supra glabra vel glabriuscula; alabastra matura glabriuscula............. 39. *heterocarpa*, var. *glabrior.*
    - Stamina 15 vel pauciora; inflorescentia non spiciformis.
      - Stamina 15; fructus globosi vel subglobosi.
        - Fructus 4–5 mm. diametro aculeis inclusis, corpore tomentoso, aculeis glabris; nervi subtus pilis simplicibus carentes .... 40. *rhomboidea.*
        - Fructus 8–10 mm. diametro aculeis inclusis, corpore tomentoso, aculeis dense pilosis; nervi subtus pilis longis simplicibus patentibus induti .... 41. *eriophlebia.*
      - Stamina 5–13; fructus ovoidei aculeis ciliatis...... 42. *pentandra.*
  - Fructus globosi, haud 10 mm. diametro; alabastra gracillima.
    - Aculei glabri; alabastra superne sparsiuscule setulosa. 24. *delicatula.*
    - Aculei pilosi; alabastra sparse stellato-pubescentia.. 19. *Antunesii.*
  - Fructus globosi, dehiscentes, ultra 10 mm. diametro aculeis inclusis.
    - Aculei glabri vel glabriusculi.
      - Folia membranacea, simpliciter pilosa .... 43. *annua.*
      - Folia chartacea vel coriacea, glabra vel plus minus stellato-pilosa.
        - Folia glaberrima, indivisa .... 45. *trachystema.*
        - Folia tomentosa, pubescentia vel puberula, inferiora sæpe triloba.
          - Stamina 12–25 .... 48. *macrophylla.*

Stamina 10–12.

Caules jam sub anthesi conspicue acute tuberculati; folia supra mox glabriuscula.... 46. *scandens.*

Caules etuberculati vel inconspicue tuberculati.

Species occidentalis: caules etuberculati; cornua sepalorum inconspicua; fructus 1–1·5 cm. diametro .... 47. *cordifolia.*

Species orientales vel austro-orientales.

Caules inconspicue tuberculati; cornua sepalorum conspicua; fructus 1–1·5 cm. diametro.................... 50. *effusa.*

Caules etuberculati; cornua inconspicua; fructus 1·5–2·5 cm. diametro ...... 48. *macrophylla,* var. *ruwenzoriensis.*

Aculei conspicue pilosi.

Folia submembranacea, pilis simplicibus sparsissime induta.

Aculei dense pilosi; corpus fructus reticulatum .. 44. *trichocarpa.*

Aculei sparse pilosi; corpus fructus profunde foveolatum .... 43. *annua,* forma *piligera.*

Folia plerumque crassiora, pilis stellatis (vel stellatis et simplicibus) densius induta.

Aculei semiuncati; folia plerumque tricuspidata . 30. *tomentosa.*

Aculei uncati.

Species occidentalis .... 47. *cordifolia.*

Species orientales et malagasicæ.

Folia plerumque tricuspidata .... 48. *macrophylla,* var. *Rothii.*

Folia indivisa vel plerumque indivisa .... 49. *pilosa.*

Sect. I. LEPIDOCALYX, nob.

1. **Triumfetta lepidota**, K. Schum. in Engl. Bot. Jahrb. xv. (1892) 127.

An erect shrub, 1·3 m. high. Petiolar glands 2–4 on each side. Upper leaves oblanceolate, lower suborbicular, subtrilobed, up to 14 cm. diam. Cymes 2–4 per node. Sepals 1·8–2 cm. long. Stamens about 60. Tubercles of the ovary pilose, terminated by several spinules which are either fascicled or arranged in a fan-like manner.

Northern Nigeria to Niam-niam Land:—Northern Nigeria: Nupe, *Barter*! Banks of Guara River at Gornapara, *W. R. Elliott*, 205! Eastern Chari: Snoussi country; Ndellé, *Chevalier*, 7549! 7952! Kaga Gongourou, *Chevalier*, 6568! Niam-niam Land: in the desert between Uringame and Ngoli, north of Lehssi, *Schweinfurth*, 4012!

2. **T. amuletum**, Sprague in Bull. Herb. Boiss. sér. II. v. (1905) 702.

A creeper, prostrate on the ground. Petiolar glands 3–5 on each side.

Leaves subobtuse, upper obovate, lower suborbicular, not lobed, 7–8 cm. diam. Cymes about 2 per node. Sepals 1·1–1·2 cm. long. Stamens about 25. Tubercles of the ovary minutely glandular, terminated by a single spinule.

North Nyasaland to Rhodesia:—North Nyasaland: Missale, *Nicholson*! Portuguese Nyasaland: among long grass in plains, near Kankombé, Lake Shirwa, *Kirk*, 164! Rhodesia: Mashonaland; Umtali, at 1200 m., *Engler*, 3121 *a*!

See Pl. **17.** fig. 1, fruit and tubercle.

Sect. II. PORPA, nob.

3. **T. repens**, Merrill et Rolfe in Philipp. Journ. Sc. iii. (1908) 111.

Porpa repens, Blume, Bijdr. 117 (1825); Miq. Fl. Ned. Ind. i. II. 198.
Triumfetta subpalmata, Sol. ex Hemsl. in Journ. Bot. xxviii. (1890) 2, t. 293; Britten in Banks et Sol. Ill. Austr. Pl. Cook, 11, t. 23.
T. procumbens, Benth. Fl. Austr. i. 273 (1863), partim; Bailey, Queensl. Fl. i. 155, partim; Merrill in Philipp. Gov. Lab. Publ. vi. 17; non Forst.

Leaves deeply 3–5-lobed (or some of them undivided), coarsely serrate. Fruits 6–8-celled, both body and prickles glabrous.

Seychelles, *Horne*!—Also on the Keeling Islands, islands in the Gulf of Siam, off Cambodia and Borneo, Philippine Islands, and on the Howick, Frankland, and Northumberland Islands off the coast of Queensland.

4. **T. procumbens**, Forst. f. Prodr. 35 (1786); Hemsl. in Journ. Bot. xxviii. (1890) 2, t. 293.

T. Fabreana, Gaud. Bot. Voy. Freyc. 478, t. 102 (1826).
T. radicans, Bojer in Bouton, Douzième Rapp. Ann. Maurice, 20 (1842).
T. crassifolia, Sol. ex Seem. Fl. Viti. 26 (1865), in syn.

Leaves broadly ovate or suborbicular, undivided or 3-lobed as far as the middle or less, crenate or crenate-serrate. Fruits 6–10-celled, both body and prickles pilose.

Amirante Islands: Isle des Roches, *Coppinger*! Providence Island, *Coppinger*! Galega Island, *Bouton*! Chagos Islands: Diego Garcia, *Hume*! *G. C. Bourne*, 11!—Also on the Keeling Islands, Fitzroy Island (Queensland), Purdy Islands (north of New Guinea), and widely spread in Polynesia.

See Pl. **17.** fig. 6, fruit and prickle.

Sect. III. LASIOTHRIX, nob.

Subsect. GRACILES, nob.

5. **T. Kirkii**, Mast. in Oliver, Fl. Trop. Afr. i. 259 (1868); K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 265 (1895).

Stems procumbent, much branched, very slender (hardly 1 mm. in diameter 30 cm. from the apex). Leaves palmatifid, setulose ; lobes 3–5, oblong, crenate. Inflorescences solitary at the nodes ; peduncle 5–6 mm. long, bearing three 2-flowered or 1-flowered cymes subtended by a common involucre. Sepals very markedly cucullate, 4·5 mm. long. Petals narrowly oblanceolate, 3·5 mm. long. Gonophore about 0·3 mm. long; glands subquadrate. Stamens 12, hardly 3 mm. long. Ovary 1 mm. diam., 3-celled ; bristles terminated by a single spinule. Fruit 1·5 cm. diam. including the bristles, 3-celled, about 5-seeded, stellate-tomentellous ; bristles plumose above, glabrous below.—The flowers were apparently overlooked by Masters, though present on the type specimen. The dichotomous appearance of the branching mentioned by Masters is due to the unusually vigorous growth of some of the axillary branches, which may become nearly as long as the main axes from which they arise.

German East Africa : 30 miles above the mouth of the Rovuma River, *Kirk* !

See Pl. **17**. fig. 2, fruit and bristle.

Subsect. DIGITATÆ, nob.

6. **T. digitata**, nob., comb. nov.

Ceratosepalum digitatum, Oliver, in Hook. Ic. Pl. t. 2307 (1894).

An erect undershrub. Stem apparently branched from the base, about 70 cm. high, the youngest part about 2 mm. in diameter. Leaves deeply 5–7-partite or -foliolate, tomentellous below ; segments or leaflets oblanceolate. Sepals 12–14 mm. long, horn 4–5 mm. long, inserted 0·75–1 mm. below the apex. Petals 9–10 mm. long. Disc densely villous-ciliate. Stamens 38–39 in the two flowers examined. Ovary 5–6-celled.

North Nyasaland : Fwambo, *Carson*, 1 !

The original figure and description of *Ceratosepalum digitatum* are inaccurate in several particulars : the ovules are in reality not ascending but pendulous, and the petals are not glabrous but have, on the contrary, a very dense villous band shortly above the base. The hairs on each petal are interwoven with those on the disc, and with those of the adjacent petals, so that on removal of the sepals an apparently continuous ring of hairs is seen, to which the petals appear to be attached shortly above their base. The petal shown in Ic. Pl. t. 2307 has been cut off above the band of hairs.

The cymes are figured as arising in the axils of the bracts, whereas they are borne opposite to them, the branching being sympodial as in the other species of *Triumfetta*. The lowermost bract may be carried up almost to the level of the next cyme above, in which case the latter appears to be axillary on superficial examination. The inflorescence differs from that of *T. macrocoma* in having the uppermost leaves reduced to bracts and in being more contracted.

In discussing the validity of the genus *Ceratosepalum*, which he rightly reduced, Schumann stated (Engl. Bot. Jahrb. xxxii. 134) that the ovary was 2-celled. *C. digitatum*, however, has a 5–6-celled ovary, as described by Oliver.

7. **T. macrocoma**, K. Schum. in Engl. Bot. Jahrb. xxxii. (1902) 133.

An erect undershrub. Stems freely branched above, 80–140 cm. high, the youngest part about 1 mm. in diameter or less. Leaves more or less deeply 3–5-partite, sometimes trifoliolate with deeply 2-partite lateral leaflets, pubescent below; segments or leaflets lanceolate. Sepals 9–10 mm. long; horn 2·5 mm. long, inserted almost at the apex. Petals 7–8 mm. long. Stamens 27–37 in the three flowers examined. Disc sparingly and shortly ciliate. Ovary 2-celled. Fruit 3–5 cm. in diameter including the bristles.

Angola: Benguella; Bailundo Distr., at 1500 m., *Wellman*! Huilla, on the stony slopes of the chalk-hills at 1740 m., *Dekindt*, 74! 233! Near the Fort Princeza Amelia, Kubango, *Gossweiler*, 3916!

8. **T. trifida**, nob., sp. nov.

Caulis ferrugineo-furfuraceo-tomentosus. Folia usque ad vel ultra medium triloba, lobo medio quam lateralibus patulis majore, 3–5 cm. longa, 4·5–7·5 cm. lata (suprema subindivisa, suborbicularia, basi obtusa, circiter 2·5 cm. diametro), basi late retusa vel subtruncata, subquinquenervia, serrata vel serrulata, utrinque pilis stellatis subtus numerosioribus scaberrima, supra nervis inconspicuis venulis occultis, subtus nervis prominentibus venulis valde reticulatis; lobi ovati vel ovato-oblongi, 1·5–3·5 cm. longi; petioli 2–3·5 cm. longi, furfuraceo-tomentelli; stipulæ triangulari-subulatæ, circiter 6 mm. longæ, setoso-ciliatæ. Inflorescentia terminalis et axillaris, cymis solitariis oppositifoliis; bracteæ involucrantes stipulis conformes, 8 mm. longæ, 1–1·5 mm. latæ, setoso-ciliatæ. Sepala linearia, inferne ampliata, 1·5 cm. longa, basi 2·8 mm. lata, medio 1·4 mm. lata, 4 mm. supra basin reflexa, extra pilis stellatis scabrido-tomentosa, purpurascentia, cornu subapicali robusto 1·8 mm. longo. Petala anguste oblanceolata, circiter 11 mm. longa, 3 mm. lata, inferne intus linea transversa dense villosa. Glandulæ gonophori quadrangulares, approximatæ, 0·6 mm. longæ, 1 mm. latæ. Discus dense villosus. Stamina 29–31. Ovarium 4–5-loculare, dense villosum; villi 1·5–2 mm. longi.

Youngest part of stem about 2 mm. in diameter. Leaves trilobed to the middle or beyond, scabrid-pubescent below; lobes ovate or ovate-oblong. Sepals 15 mm. long; horn hardly 2 mm. long, inserted almost at the apex. Petals 11 mm. long. Disc densely villous. Stamens 29–31 in the two flowers examined. Ovary 4–5-celled.

Congo Free State: Lubombo, Choma River, Mwero, *Descamps*! (Herb. Berol.).

Subsect. ACTINOCARPÆ, nob.

9. **T. actinocarpa**, S. Moore in Journ. Bot. xv. (1877) 66.

A dense virgately branched shrub, 1 m. high. Branchlets furfuraceous-puberulous. Leaves 4–13 mm. in diameter, dentate-serrate, finely tomentellous on both surfaces, afterwards pubescent above; petioles slender, 2–10 mm. long, puberulous. Sepals linear-spathulate, 6·5 mm. long, 1·4 mm. broad, horn 1·5–2 mm. long. Petals 5 mm. long, 2–2·2 mm. broad. Gonophore 0·7 mm. long; glands longer than broad. Disc hardly 0·3 mm. long. Stamens about 40, 4·5–5 mm. long. Ovary 1 mm. long including the bristles; bristles terminated by a single spinule, under 0·5 mm. long including the spinule. Fruit about 1·5 cm. in diameter including the bristles.

In the original description the ovary was described with some doubt as bilocular. We were fortunate in finding an undamaged bud, and are able to confirm this.

Somaliland: Ahl Mountains, at 1500 m., *Hildebrandt*, 882!

10. **T. pleiacantha**, nob., sp. nov.

Rami lignosi, albidi, striati, glabri; ramuli 0·75–1·5 mm. diametro, fulvo-tomentelli. Folia suborbicularia, basi rotundata vel subtruncata, apice obtusa vel rotundata, 7–20 mm. diametro, crenato-serrata, utrinque albido-tomentella; petioli 2–7 mm. longi, tomentelli. Sepala linearia, 12·5 mm. longa, 1·4 mm. lata, cornu 1 mm. longo fere in apice inserto. Petala obovato-spathulata, 10 mm. longa, vix 4 mm. lata, inferne 1 mm. ciliata. Gonophorum 0·4 mm. longum, glandulis transverse oblongis 0·3 mm. longis, 0·5 mm. latis. Discus annularis, membranaceus, ciliatus, 0·5–0·6 mm. longus. Stamina circiter 35, 9–10 mm. longa. Ovarium 2·5 mm. longum setis inclusis; setæ stellato-pilosæ, spinulis 4–6 (2–7) terminatæ, 1–1·75 mm. longæ spinulis inclusis. Fructus fere 2 cm. diametro setis inclusis.

Branchlets tomentellous. Leaves 7–20 mm. in diameter, crenate-serrate, coarsely tomentellous on both surfaces; petioles not slender, 2–7 mm. long, tomentellous. Sepals linear, 12·5 mm. long, 1·4 mm. broad, horn 1 mm. long. Petals 10 mm. long, hardly 4 mm. broad. Gonophore 0·4 mm. long; glands broader than long. Disc 0·5–0·6 mm. long. Stamens about 35, 9–10 mm. long. Ovary 2·5 mm. long including the bristles; bristles terminated by several spinules, 1–1·75 mm. long including the spinules. Fruit almost 2 cm. in diameter including the bristles.

Somaliland: alluvial plain near the Shebele River, *James & Thrupp*!

Subsect. SONDERIANÆ, nob.

11. **T. Sonderii**, Ficalho et Hiern in Trans. Linn. Soc. ser. II. Bot. ii. (1881) 17: K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 265 (1895).

T. trichocarpa, Sond. in Linnæa, xxiii. (1850) 19; Harv. Thes. Cap. t. 52 (1859); Harv. et Sond. Fl. Cap. i. 228 (1860); Szysz. Thalamifl. Rehmann. 151 (1887); non Hochst.

T. Sonderiana, Bolus in Journ. Linn. Soc., Bot. xxiv. (1887) 173.

A small erect undershrub. Rhizome woody. Stems 3–4 mm. in diameter at the base; branches numerous, sharply ascending. Leaves oblong, lanceolate-oblong or elliptic-oblong, 3-nerved at the base, stellate-hispidulous. Sepals 9 mm. long, cucullate at the apex; horn 1·2–1·5 mm. long. Gonophore as long as the disc. Stamens 15–20. Bristles of ovary pilose, terminated by a single long spinule. Capsule 3–4 cm. in diameter including the bristles; hairs on the bristles mostly solitary, a few binate.—Sonder described the cells as being uniovulate; they are, however, biovulate as is usual in *Triumfetta*.

Transvaal: near the Vaal River, *Burke*, 83! 265! *McLea*, 5594! Makapansberge, Streydpoort, *Rehmann*, 5794! Above Aapies River, Pretoria, *Rehmann*, 4356! near Pretoria, *Mrs. Stainbank*, 3654! *Kuntze*! *Schlechter*, 4145! Hoogeveld, between Standerton and Pretoria, and near Heidelberg, *Wilms*, 1009! without precise locality, *Zeyher*, 147!

See Pl. **17**. fig. 3, fruit and bristle.

Subsect. PANICULATÆ, nob.

12. **T. geoides**, Welw. ex Mast. in Oliver Fl. Trop. Afr. i. 256 (1868); Hiern, Cat. Welw. Afr. Pl. i. 97 (1896); K. Schum. in Warb. Kunene-Sambesi Exped. 299 (1903).

Stems fulvous-tomentose, leafy and flowering, usually not distinct. Leaves pubescent or puberulous, in a dried state dark green or brown on the upper surface, fulvous-tomentose on the lower. Stipules 4–5 mm. long. Stamens about 20. Fruits 2·5–3 cm. in diameter including the bristles.

The following varieties may be distinguished:—

a. **typica**, nob.; folia supra non vel vix rugosa, primum stellato-pubescentia, demum puberula, exsiccando brunnea vel viridula.

Angola: Huilla; near Lopollo, *Welwitsch*, 1413! Humpata, *Bertha Fritsche*, 238! sandy ground on the slopes of hills, 1700–1800 m., *Dekindt*, 50! Kassinga and Kubango, at 1400 m., *Baum*, 236! Knelleis (Maramba), 1400 m., white sandy ground on the edge of a wood, *Baum*, 236!

In Baum's material there are two kinds of shoots: those bearing both leaves and flowers, which are fulvous-hirsute; and leafless flowering shoots which are brownish and sparingly pubescent.

β. **rugosa**, nob.: folia supra rugosa, nervis stellato-pilosis ceterum pilis plerumque simplicibus setulosa, exsiccando intense viridia.

Angola: Malange Distr.; Toba Quatungi, *Gossweiler*, 1447! 1448! between Sanza and Malange, *Pogge*, 11!

13. **T. rhodoneura**, K. Schum. in Engl. Bot. Jahrb. xxxii. (1902) 134.

Leafy and flowering stems distinct, the former reddish-tomentose, the latter fulvous-tomentose, aphyllous, branched from the base. Leaves tomentose on both surfaces, in a dried state reddish-brown on the upper surface. Stipules about 1 cm. long. Disc pilose on the inner surface. Stamens 23–26. Fruits 2·5–3 cm. in diameter including the bristles.

Angola: Benguella; near Huilla, *Antunes*, 50!

Schumann's description of *T. rhodoneura* is inaccurate in several particulars: the disc does not consist of broad ovate scales, but forms an undulate ring; the petals are not glabrous below; and the under surface of the fully developed leaves is buff-coloured in a dried state, not red; both surfaces are reddish, however, in a young state.

There are two sheets of *T. rhodoneura* in the Berlin Herbarium: on the first all the flowering shoots are fulvous-tomentose, as described by Schumann; the solitary flowering shoot on the second sheet, however, is brownish and only sparingly pubescent, just like Baum's specimen of *T. geoides*. If there has been no mixture of specimens and the indumentum really varies to this extent, it may be questioned whether *T. rhodoneura* is specifically distinct from *T. geoides*. It might perhaps be treated as a variety.

14. **T. iomalla**, K. Schum. in Engl. Bot. Jahrb. xv. (1892) 132.

Whole plant densely rusty-tomentose. Stems of one kind, bearing both leaves and inflorescence, 20–30 cm. long, 3–4 mm. in diameter at the base, flexuous, the inflorescence developed with, or after, the leaves. Leaves elliptic-oblong or ovate-lanceolate, acute at the apex, rounded at the base, 3–6 cm. long, 1·5–2·5 cm. broad, serrate, pubescent or tomentose above, woolly-tomentose below. Stamens 30–34.

Congo Free State: Mussumba, *Pogge*, 21!

15. **T. hirsuta**, nob., sp. nov.

Caules validiusculi, leviter flexuosi, 10–60 cm. longi, basi 2·5–4·5 mm. diametro, superne ± hirsuti, inferne glabrescentes. Folia ± anguste oblanceolata vel lanceolata, dentato-apiculata, in basin angustata, 5–10 cm. longa, 0·5–2 cm. lata, acutiuscule serrata, pilis stellatis et simplicibus hirsuta, præcipue in innovationibus. Inflorescentia 4–10 cm. longa, fulvo-tomentosa. Sepala 7·5–10 mm. longa, 1·5–1·75 mm. lata, extra aureo-tomentosa, intus venis 5–7 distinctis, cornu 0·3–0·5 mm. longo. Petala obovata, apice rotundata vel ± emarginata, 6·5–9·5 mm. longa, 3·5–5 mm. lata. Stamina 23–28. Fructus circiter 2 cm. diametro setis inclusis.

Stems either all flowering, or some purely vegetative, stoutish, slightly flexuous, 10–60 cm. long, 2·5–4·5 mm. in diameter at the base, more or less hirsute above, glabrescent below, the inflorescence developed before or with the leaves. Leaves oblong-lanceolate, linear-oblanceolate or lanceolate, acutely apiculate, narrowed towards the base, 5–10 cm. long, 0·5–2 cm. broad, rather sharply serrate, hirsute with both stellate and simple hairs, more especially in a young state. Inflorescence 4–10 cm. long. Stamens 23–28. Fruits about 2 cm. in diameter including the bristles.

Transvaal : hills at Shilouvane, *Junod*, 605 ! 667 ! hills near Barberton, at 1200 m., *Thorncroft* in Herb. J. M. Wood, 4353 ! grassy mountain-sides, Saddleback Range, Barberton, *Galpin*, 478 ! Mount Sheba, near Barberton, at 1140 m., *Bolus*, 7688 ! Pilgrim's Rest, Lydenburg Goldfields, *Atherstone* !

16. **T. Mastersii**, Baker f. in Trans. Linn. Soc. ser. II. Bot. iv. (1894) 6 ; K. Schum. in Engl. Bot. Jahrb. xxx. (1901) 352.

T. Welwitschii, Mast. in Fl. Trop. Afr. i. 255 (1868), quoad plantam nyasanum.

α. **typica**, nob.—Stems of two kinds, some bearing both leaves and inflorescences, others produced later purely vegetative, all stoutish, slightly flexuous, 30–55 cm. long, 3–4·5 mm. in diameter at the base, glabrescent below, the inflorescence developed before or with the leaves. Leaves oblanceolate-oblong or obovate-oblong, apiculate from an obtuse or rounded apex, narrowed to the base, 5–9·5 cm. long, 1·5–4 cm. broad, conspicuously serrate, in a young state tomentellous or softly pubescent below, glabrescent or glabrous below in the adult state, and very closely and distinctly reticulated. Inflorescence 3–10 cm. long. Stamens 30–40 (28–53).

Portuguese E. Africa : Beira, *Braga* ! Sotshi, at 900 m., *Kirk* ! between Impempe and Sotshi, *Kirk* ! near Kankanje, *Kirk* ! Nyasaland : Zomba, *Purves*, 147 ! Shire Highlands, *Adamson*, 16 ! Ruo, *Scott Elliot*, 8672 ! Mt. Milanji, *Whyte*, 105 ! 163 ! without locality, *Buchanan*, 260 ! 1341 ! *Buchanan, in Herb. J. M. Wood*, 6985 ! Matabeleland, *Oates*.

β. **Descampsii**, nob.—*T. Descampsii*, De Wild. et Th. Dur. in Bull. Soc. Bot. Belg. xxxix. 2. (1901) 95 ; Ann. Mus. Congo, sér. V. i. 164.

Differs from the type in the indumentum of the leaves, which are harshly and sparingly stellate-pubescent on the lower surface in a young state.

Congo Free State : Babondo (Lomami), *Descamps* ; Lukafu, *Verdick* ! Haut-Marungu, *De Beerst*. Nyasaland : Umalila, M'pesu Mt., steep slopes, 2000 m., *Goetze*, 1362 ! (partim). Angoniland, *Purves*, 54 ! (a form with leaves nearly glabrous from an early stage).

γ. **heliocarpa**, nob.—*T. heliocarpa*, K. Schum. in Engl. Bot. Jahrb. xv. (1892) 131.

Stems of one kind, 22–32 cm. long, about 4 mm. in diameter near the base, slightly flexuous, fulvous-tomentose, eventually glabrescent below and reddish near the base, bearing 2–4 leafy branches 9–17 cm. long, and a terminal inflorescence, the latter developed with the leaves. Leaves oblong, truncate or rounded at the apex or obtusely apiculate, rounded or narrowed into the base, 5–7·5 cm. long, 1·8–3·3 cm. broad, conspicuously serrate, slightly wrinkled and stellate-puberulous above, fulvous-tomentose or tomentellous below in the adult state. Inflorescence 12–14 cm. long. Stamens 32–38. Young fruits 1·8 cm. in diameter including the bristles.

Congo Free State: Lulua River, *Pogge*, 10! South Rhodesia: between Broken Hill Zinc Mine and Bwana M'cuba Copper Mine, *Allen*, 327!

17. **T. Welwitschii**, Mast. in Oliver, Fl. Trop. Afr. i. 255 (1868), quoad plantam angolensem; Baker f. in Trans. Linn. Soc. ser. II. Bot. iv. (1894) 7; Dewèvre, in Bull. Soc. Bot. Belg. xxxiii. 2 (1895) 98; Hiern, Cat. Welw. Afr. Pl. i. 97 (1896).

a. **typica**, nob.—Stems of two kinds, some bearing both leaves and inflorescence, others purely vegetative, all slender, nearly straight, 30–45 cm. long, 1·5–2·5 mm. in diameter at the base, glabrescent below, the inflorescence developed before the leaves. Leaves linear-lanceolate or oblanceolate, acute at the apex, narrowed towards the base, 6–11 cm. long, 8–18 mm. broad, entire or very slightly serrulate, tomentellous below in the adult state. Inflorescence 3–4 cm. long. Stamens 21–25.

Angola: Pungo Andongo; frequent in stony pastures and in rather dry bushy places, from the river Lutete to Candumba, *Welwitsch*, 1414! Malange Distr.; on hard clay soil along the road between Quizanga and Catumba on the line from Luculla to Malange, *Gossweiler*, 1437! 1438! near Keiando close to the old fort Lusitania, Hanha, *Gossweiler*, 1762! from Keiando to the Cubal River, along the Carriers' path to Hanha, *Gossweiler*, 1750! Huilla; slopes of sandy hills, 1740 m., *Antunes*, 134! 155!

β. **Rehmannii**, nob.—*T. Rehmannii*, Szysz. Thalamifl. Rehmann. 151 (1887).

Stems of one kind, bearing both leaves and inflorescence, stoutish, flexuous, densely pubescent, over 35 cm. long, about 3·5 mm. in diameter 30 cm. from the apex, the inflorescence developed a little before the leaves. Leaves linear-oblong, apiculate from an obtuse apex, narrowed towards the base, 5 6 cm. long, 6 8 mm. broad, serrulate, tomentellous below in the adult state. Inflorescence about 15 cm. long.

Rhodesia: Mashonaland; Rusapi, above Umtali, 1300 m., in sandy places, *Engler*, 3116! Laterite steppe, near Salisbury, 1500 m., *Engler*, 3082! Bechuanaland; in sandy places, 1200 m., *Marloth*, 3327! Transvaal: Houtbosch, *Rehmann*, 6316!

A specimen collected by Baines in the "South African Gold-fields" apparently belongs to var. *Rehmannii*. The flowers have 25–32 stamens.

γ. **laxiflora**, nob.—*T. laxiflora*, Engl. in Engl. Bot. Jahrb. xxxix. (1907) 579.

About 40 cm. high. Stems of one kind, bearing vegetative branches 15–21 cm. long below, and terminated by the inflorescence which is developed at the same time as the leaves. Young parts stellate-tomentellous or pubescent. Leaves linear-oblong, acute or apiculate at the apex, very gradually narrowed into the base, 5–8 cm. long, 5 9 mm. broad, serrulate except near the base, puberulous above and fulvous-tomentellous or pubescent below in a young state, finally glabrous above, sparingly pubescent or puberulous below especially on the nerves. Inflorescence laxly panicled; pedicels as long as or longer than the flowers. Stamens 25–31. Ovary 2–4-celled. Immature fruit 1·8 cm. in diameter including the bristles.

Rhodesia: Mashonaland; on stony steppes at Norton, near Salisbury, 1500 m., *Engler*, 3025! between Broken Hill zinc-mine and Bwana M'cuba copper-mine, *Allen*, 290! 370!

Sect. IV. LAPPULA, DC., sensu amplif.

18. **T. Dekindtiana**, Engl. in Engl. Bot. Jahrb. xxxix. (1907) 580.

T. Dekindtiana was originally described from fruiting material. A description of the flowers is now given.

Cymæ pro nodo plures (usque ad 13), involucratæ, plerumque simplices, trifloræ, 1–2 tantum compositæ, multifloræ; pedunculi 5–8 mm. longi; involucri bracteæ 5, 3–5 mm. longæ, minores subulatæ, majores lanceolatæ vel lineari-lanceolatæ. Sepala 1·5 mm. supra basin reflexa, linearia, 6–9 mm. longa, basi 1 mm. ceterum 0·5 mm. lata, extra tomentella, cornu 0·5 mm. longo vix infra apicem inserto. Petala oblongo-oblanceolata, apice rotundata vel retusa, 4–5 mm. longa, 1–1·5 mm. lata, basi per 0·75 mm. ciliata. Gonophorum 0·5–0·75 mm. longum, glandulis obovatis circiter 0·5 mm. longis. Discus 0·4 mm. longus, dense ciliatus, anthesi reflexus. Stamina 10; filamenta circiter 6 mm. longa. Ovarium depresso-globosum, circiter 1 mm. diametro, tomentellum, 4-loculare. Capsulæ setæ 2·5–4 mm. longæ, dense stellato-pilosæ, apice 6–8-spinulatæ.

A bushy herb or undershrub, 0·3–1·5 m. high. Young stem tomentellous, afterwards scurfy-pubescent, more or less glabrescent towards the base. Leaves ovate, ovate-oblong or oblong-lanceolate, acute, obtuse or rounded at the apex, tomentellous on both surfaces; petioles 5–15 mm. long; stipules 2–5 mm. long. Capsule about 1 cm. in diameter including the bristles, 4-celled; bristles plumose, with about 6–8 terminal spinules.

Angola to Rhodesia and German East Africa:—Angola: Huilla, in bushes at Mounyino, 1760 m., fruiting in May, *Antunes*, 363! (partim). Mossocollos of Kassuango, Kuiriri, *Gossweiler*, 3001! Rhodesia: Batoko plateau, flowering in February, *Allen*, 435! N. Melsetter, Umvumvumvu River, 1200 m., fruiting in April, *Swynnerton*! German East Africa: Muansa, south of Victoria Nyanza, *Stuhlmann*, 4524!

19. **T. Antunesii**, nob., sp. nov.

Suffrutex gracilis, 0·5–1·2 m. altus, ramis stellato-pubescentibus inferne glabrescentibus elevato-reticulatis circiter 4 mm. diametro, 65–70 cm. infra apicem. Folia ovato-lanceolata (superiora lanceolata), basi rotundata vel obtuse cuneata, apice obtusa vel subacuta, 4·5–6·5 cm. longa, 1·5–3 cm. lata, irregulariter serrulata, chartacea, leviter discolora, basi 5-nervia, nervis supra inconspicuis subtus prominentibus exterioribus parvis, supra dense pubescentia subtus tomentella; petioli 0·5–1·5 cm. longi. Inflorescentia foliata, foliis superioribus 1·5–2 cm. longis, usque ad 30 cm. longa. Cymæ pro nodo circiter 6; pedunculi pubescentes, 3–4 mm. longi. Alabastra gracilia, extra sparsiuscule stellato-pubescentes, matura in sicco 5–6 mm. longa. Sepala purpurascentia, linearia, 7·5 mm. longa, 0·5 mm. lata, cornu 0·3 mm. longo densiuscule pubescente. Petala oblanceolato-linearia, 4·5 mm. longa, 1 mm. lata. Glandulæ suborbiculares, 0·2 mm. diametro. Stamina 10, 5–6 mm. longa. Ovarium 4-loculare. Fructus juvenilis tantum visus; aculei uncinati, longe setosi.

A slender undershrub 0·5–1·2 m. high. Leaves ovate-lanceolate, rounded or obtusely cuneate at the base, obtuse or subacute at the apex, 4·5–6·5 cm. long, 1·5–3 cm. broad, densely pubescent above, tomentellous below. Inflorescence leafy. Buds very slender, sparingly stellate-pubescent. Horns of the sepals densely pubescent. Stamens 10. Ovary 4-celled. Prickles of fruit uncinate, setose.

Angola: Huilla; Mounyino, *Antunes*, 363! (partim), under trees, *Dekindt*, 277!

Apparently allied to *T. Dekindtiana*, Engl., from which it differs in the uncinate prickles.

20. **T. micrantha**, K. Schum. in Engl. Bot. Jahrb. xv. (1892) 128.

Branches scabrid-pubescent with short hairs. Petioles slender, 5–15 mm. long. Mature leaves lanceolate-oblong, 6–8 cm. long, 1·5–2 cm. broad, serrulate, scabrid on the upper surface, hairs inconspicuous, mostly simple, tomentose or pubescent below. Petals spathulate, retuse. Prickles densely pilose, with 2–8 terminal spinules.

Bongoland: Ssabbi, *Schweinfurth* (ser. iii.), 16!

Very young leaves are stellate-pilose on the upper surface, but the stellate hairs gradually disappear, so that long before the leaves are adult most of the hairs on the upper surface are simple.

21. **T. setulosa**, Mast. in Oliver, Fl. Trop. Afr. i. 259 (1868); Hiern, Cat. Welw. Afr. Pl. i. 100 (in part).

T. Hensii, De Wild. et Th. Dur. in Bull. Soc. Bot. Belg. xxxix. II. (1900) 93; Ann. Mus. Congo, sér. I. i. (1902) 189, t. 95; sér. V. i. (1903) 56.
T. orthacantha, Durand et Schinz, Études Fl. Congo, i. 82, non Welw.

Bush about 1 m. high. Branches hirsute, tomentose in a young state. Petioles stoutish, 3–6 mm. long. Mature leaves ovate-lanceolate, 3·5–5 cm. long, rather irregularly serrate, clothed with stellate and long simple hairs on the upper surface, the stellate hairs eventually disappearing for the most part, tomentose below. Sepals stellate-pubescent outside, horn with 1–3 bristles. Petals oblong, rounded. Capsule about 7 mm. in diameter including the prickles. Prickles densely pilose, with 2–6 terminal spinules.

British East Africa to Angola:—British East Africa: Kavironda, tall and climbing amongst long grass, *Scott Elliot*, 7152! Congo Free State: Ngombe-Lutete, *Hens* (ser. A), 269! Angola: Pungo Andongo; in bushy stony places between Caghuy and Mangue, fls. and fr., middle of April, rather rare, *Welwitsch* (in Herb. Mus. Brit.), 1410!

Var. **Gilletii**, nob.—*T. Gilletii*, De Wild. in Ann. Mus. Congo, sér. V. i. 55 (1903).

Prickles almost glabrous, with 1–4 terminal spinules.

Congo Free State: Kisantu, *Gillet*, 531, 945, et sine numero! Campine, near Mussenge, *Pogge*, 612!

22. **T. angolensis**, nob., sp. nov.

T. setulosa, Hiern, Cat. Welw. Afr. Pl. i. 100, partim, non Mast.

Herba annua, usque ad 80 cm. alta, e basi ramosa, ramis simplicibus vel subsimplicibus teretibus stellato-pilosis. Folia elliptica ovato-elliptica vel lanceolato-oblonga, apice rotundata vel subacuta, 2–7·5 cm. longa, 1–4·5 cm. lata, serrata vel serrato-crenata, utrinque subtus magis stellato-pilosa, pilis nonnullis simplicibus, tandem puberula, nervis utrinque 3–4, subtus elevatis; stipulæ subulatæ, 3 mm. longæ, longe pilosæ. Inflorescentia foliata; cymæ pro nodo usque ad 5, trifloræ; pedunculi usque ad 3 mm. longi; bracteæ lanceolatæ, 2·5 mm. longæ, basi 0·5 mm. latæ. Sepala linearia, 5 mm. longa, 0·5 mm. lata, extra stellato-pubescentia, cornu 0·5 mm. longo pilis simplicibus ornato. Petala oblanceolata, apice rotundata, 5 mm. longa, 1 mm. lata, basi ciliata. Gonophorum 0·5 mm. altum, glandulis transverse elliptico-oblongis. Discus 0·3 mm. longus, ciliatus. Stamina 10; filamenta circiter 5 mm. longa, inter se libera, subteretia. Ovarium subglobosum, circiter 0·75 mm. diametro, 4-loculare. Capsula pallide brunnea, 6–7 mm. diametro aculeis inclusis, aculeis patenter pilosis, spinulis 2–5 terminatis.

0·3–0·8 m. high, branched from the base. Hairs on the stem stellate. Leaves oblong or elliptic, 2–7·5 cm. long, 1–4·5 cm. broad, stellate-pubescent on both surfaces. Sepals stellate-pilose outside, horn with several small bristles. Filaments free at the base. Prickles of the fruit pilose, with 2–5 terminal spinules.

Angola: Huilla; in bushy places along the borders of woods in Matas de Monino, *Welwitsch*, 1411! Mounyino, 1760 m., *Antunes*, 312! in waste places at Kassuango Kuiriri, *Gossweiler*, 3016!

Differs from *T. setulosa* chiefly in habit and indumentum.

23. **T. paradoxa**, nob., sp. nov.

T. setulosa, var. (?) *paradoxa*, Welw. ex Hiern, Cat. Welw. Afr. Pl. i. 100.

Herba annua, gracilis, erecta. Rami pilis simplicibus hirsuti. Folia ovata usque lanceolata, basi rotundata, apice acuta, 2·5–5·5 cm. longa, 1–2·5 cm. lata, serrata, supra pilis simplicibus appressis, subtus pilis simplicibus et stellatis parce induta; petioli 4–11 mm. longi; stipulæ longe ciliatæ. Sepala 5 mm. longa, circiter 0·7 mm. lata, extra superne pilis simplicibus vel bifurcatis hirsuta, pilis nonnullis parvis stellatis caducis interjectis, cornu 0·5 mm. longo setuloso. Petala oblanceolata, 3·5–4 mm. longa, 1·3–1·5 mm. lata. Stamina 10. Filamenta in basin dilatato-complanata ± connata. Ovarium 4-loculare. Capsula nigra, 8–9 mm. diametro aculeis inclusis, glabra, aculeis glabris basi dilatatis, spinulis 2–6 terminatis.

An annual, slender, erect herb. Hairs on the stem and the upper surface of the leaves simple. Sepals pilose outside towards the apex only, hairs simple or bifurcate. Filaments distinctly broadened and more or less connate at the base. Prickles and fruit-body glabrous. Prickle with 2–6 terminal spinules.

Congo Free State: Lunda; Mussumba, *Pogge*, 26! Angola; Golungo Alto; in hilly places of the mountains of Serra de Alta Queta, *Welwitsch*, 1412 (herb. Mus. Brit.)! [*Welwitsch*, 1410, in herb. Kew.]

Small stellate hairs occur amongst the little bristles on the upper half of young buds; they drop off before the bud is fully developed.

24. **T. delicatula**, nob., sp. nov.

Suffrutex gracilis, 0·8–1·5 m. altus, ramis stellato-pubescentibus minute tuberculatis circiter 2·5 mm. diametro 35–40 cm. infra apicem. Folia ovata vel ovato-lanceolata (superiora anguste lanceolata), basi rotundata vel obtuse cuneata, apice acuta vel subacuta, 3–8 cm. longa, 1–3·5 cm. lata, irregulariter serrata, chartacea, leviter discolora, basi 5-nervia, nervis lateralibus supra indistinctis subtus prominentibus, supra sparse subtus densius pubescentia; petioli 0·5–1·5 cm. longi. Inflorescentia foliata, foliis superioribus 1·5–2 cm. longis, usque ad 16 cm. longa. Cymæ pro nodo circiter 4; pedunculi usque ad 3 mm. longi, pubescentes. Alabastra superne sparse setulosa, pilis simplicibus biradiatis et stellatis, matura in sicco 5–6 mm. longa. Sepala purpurascentia, linearia, 8 mm. longa, 0·7 mm. lata, cornu 0·25 mm. longo sparse setuloso. Petala oblanceolata, 4·5–5 mm. longa, 1–1·2 mm. lata. Glandulæ suborbiculares, 0·2 mm. diametro. Stamina 10, 5–6·5 mm. longa. Ovarium

4-loculare. Fructus glabri, vix 1 cm. diametro aculeis inclusis, aculeis uncinatis glabris.

A slender undershrub, 0·8–1·5 m. high. Leaves ovate or ovate-lanceolate, rounded or obtusely cuneate at the base, acute or subacute at the apex, 3–8 cm. long, 1–3·5 cm. broad, sparingly pubescent above, more densely pubescent below. Inflorescence leafy. Buds very slender, sparingly setulose in the upper part, glabrescent in the lower. Horns of the sepals sparingly setulose or glabrescent. Stamens 10. Ovary 4-celled. Fruits glabrous, less than 1 cm. in diameter including the prickles; prickles uncinate.

Angola: Huilla; stony ground in open spaces on Monyno Mt., 1780 m., *Antunes*, 141! under trees, Mounyino, 1760 m., *Antunes*, 316!

Apparently allied to *T. paradoxa*, nob., from which it may be distinguished by the uncinate prickles.

25. **T. intermedia**, De Wild. in Ann. Mus. Congo, sér. V. i. (1903) 56.

The following detailed description of this little-known species has been drawn up from the material collected by Buchanan:—

Rami graciles, teretes, circiter 2 mm. diametro 30 cm. ab apice, stellato-pubescentes, demum subglabri, internodiis 4–7 cm. longis. Folia oblongo-lanceolata, 4–8 cm. longa, 0·8–2 cm. lata, acuta vel subacuta, denticulato-serrata, dentibus 3–6 mm. (sæpissime 5 mm.) distantibus, supra pilis simplicibus parce setulosa, subtus pilis paucis simplicibus et stellatis, nervis utrinque circiter 4 supra indistinctis subtus prominentibus. Petioli 4–14 mm. longi, stellato-pubescentes. Stipulæ subulatæ, 4–5 mm. longæ. Cymæ pro nodo usque ad 7; pedunculi 3–4 mm. longi; bracteæ subulatæ, 2–2·5 mm. longæ, ciliatæ. Sepala linearia, 4–5 mm. longa, 0·5–0·75 mm. lata, extra inferne glabra, apicem versus sparsiuscule stellato-pilosa, cornu 0·5 mm. longo setula unica terminato. Petala oblanceolata, apice rotundata, 4–4·5 mm. longa, 1–1·25 mm. lata, inferne 0·5 mm. parce pilosa. Gonophorum vix 0·5 mm. altum, glandulis transverse oblongis 0·25 mm. longis. Stamina 10; filamenta 3–4 mm. longa. Ovarium subglobosum, 0·75 mm. diametro, 4-loculare; stylus circiter 3 mm. longus. Capsula (immatura tantum visa) globosa, aculeis subglabris apice 1–4-spinulatis.

Plant branched above. Stem stellate-pubescent, soon glabrescent. Leaves oblong-lanceolate, 4–8 cm. long, 0·8–2 cm. broad, sparingly pilose with simple hairs on the upper surface, and with both simple and stellate hairs on the lower. Stipules 4–5 mm. long, subulate. Sepals glabrous below, sparingly stellate-pilose above, horn terminated by a single bristle. Petals rounded at the apex, pilose at the base. Stamens 10. Prickles not broadened at the base, with 1–4 terminal spinules.

Congo Free State: Kisantu, *Gillet*, 531 (bis)! Nyasaland: without precise locality, *Buchanan*, 216! 614!

26. **T. buettneriacea**, K. Schum. in Engl. Bot. Jahrb. xv. (1892) 129.

Plant branched above, over 0·6 m. high. Stem stellate-pubescent. Leaves lanceolate or oblong-lanceolate, 5–8 cm. long, 1–3 cm. broad, sparingly pilose on both surfaces; hairs on the upper surface simple or both simple and stellate, those on the lower surface mixed or mostly stellate. Stipules 1–2 mm. long. Sepals stellate-pubescent outside, horn terminated by a single bristle. Petals emarginate, puberulous at the base. Stamens 10. Prickles glabrescent, much broadened at the base, terminated by 1–4 spinules.

Djurland; Great Seriba Ghattas, *Schweinfurth*, 2458! Bongoland; Gurfala, *Schweinfurth*, 2144.

See Pl. **17.** fig. 4, fruit and prickle.

27. **T. dubia,** De Wild. in Ann. Mus. Congo, sér. V. i. (1903) 54.

Barter's specimen enables us to give a more detailed description of this interesting species, which was originally described from incomplete material.

Frutex 1–1·3 m. altus, ramis teretibus circiter 3 mm. diametro longe stellato-pubescentibus. Folia lanceolata vel ovato-lanceolata, 3–9 cm. longa, 0·6–3·5 cm. lata, acuta, basi subcuneata, serrata, dentibus setiferis 2–4 mm. distantibus, supra pilis simplicibus (nervis exceptis), subtus pilis stellatis et simplicibus pubescentia, nervis utrinque 4–6 supra prominulis subtus prominentibus. Petioli 3–18 mm. longi, subtomentosi. Stipulæ e basi ovato-lanceolata longe acuminatæ, 4 mm. longæ, acumine 2 mm. longo incluso, basi 1 mm. latæ. Inflorescentia e dichasis trifloris 5 constans. Pedunculi circiter 4 mm. longi; bracteæ subulatæ, 2–3 mm. longæ, ciliatæ; pedicelli 2–3 mm. longi. Sepala lineari-oblonga, 7 mm. longa, basi 0·75 mm. lata, extra longe stellato-pilosa, cornu 0·7 mm. longo longisetuloso. Petala oblanceolata, apice rotundata, 5 mm. longa, supra medium 1·5 mm. lata, basi per 0·5 mm. stellato-pilosa. Gonophorum 0·75 mm. altum, glandulis suborbicularibus 0·25 mm. diametro. Stamina 8–12, filamentis 5 mm. longis. Ovarium depresso-globosum, 0·75 mm. diametro, 4-loculare, loculis 2-ovulatis. Capsula (immatura tantum visa) globosa, aculeis pilosis spinulis 1–5 terminatis.

Togoland: Sokode Farm, *Schroeder*, 88! mountain savannah, 400 m., near Sokode, *Schroeder*, 112! Nigeria: Nupe, *Barter*, 1550! Congo Free State: Kisantu, *Gillet*! German East Africa: Usindja; Bugando, *Stuhlmann*, 3522!

Plant branched above, 1–1·3 m. high. Stem stellate-hirsute. Leaves lanceolate or ovate-lanceolate, 3–9 cm. long, 0·6–3·5 cm. broad, hairs on the upper surface simple (except on the nerves), on the lower both stellate and simple. Sepals fulvous-hirsute with stellate hairs. Petals oblanceolate. Prickles pilose, terminated by 1–5 spinules.

Var. **tomentosa,** nob.; foliis subtus tomentosis a typo recedit.

Togoland: Bismarckburg, on the Jegge Stream, *Büttner*, 194!

28. **T. abyssinica,** K. Schum. in Engl. Bot. Jahrb. xv. (1892) 126, et in Engl. Hochgebirgsfl. Trop. Afr. 298; Engl. Pflanzenw. Ost-Afr. A. iii. (1895); C. 265.

T. Vahlii, A. Rich. Fl. Abyss. i. 83 (1847), non Poir.

An erect, much-branched shrub. Leaves lanceolate, oblong-lanceolate, or ovate-lanceolate, rounded or subcordate at the base, acute, 6–12 cm. long, 1·5–6 cm. broad, shortly stellate-pubescent on both surfaces, more sparingly on the upper. Sepals about 10 mm. long, horn 0·5 mm. long. Stamens 10. Ovary 4–5-celled. Fruit 8–10 mm. in diameter including the prickles, prickles short and rather stout, densely pilose.

Abyssinia: on mountains near Lake Amba, 1900 m., and on Mt. Scholoda, 2000 m., *Schimper* (1863–8), 853! Mount Scholoda, *Schimper* (sect. 2) 357! small shrub near Djeladjeranne, *Schimper* (sect. 3), 1473!

29. **T. orthacantha**, Welw. ex Mast. in Oliver, Fl. Trop. Afr. i. 258 (1868); Hiern, Cat. Welw. Afr. Pl. i. 99 (1896).

Possibly only a form of *T. tomentosa*, from which it seems to differ in little but the indumentum and shape of the leaves (see key).

Angola: Golunga Alto; in dense thickets of primitive woods and amongst *Pennisetum* along the banks of the Quibolo stream, near Sange, *Welwitsch*, 1415! Pungo Andongo; at the bushy margins of woods, along the banks of the river Luxillo, *Welwitsch*, 1416!

A specimen collected in Damaraland by T. G. Een (Brit. Mus.) seems to belong here.

30. **T. tomentosa**, Boj. Hort. Maurit. 43, nomen (1837); et in Bouton, Douzième Rapp. Ann. Maur. (1842) 19; Mast. in Hook. f. Fl. Brit. Ind. i. 394 (1874); Engl. Pflanzenw. Ost-Afr. A. 22, 111 (1895); K. Schum. in Engl. l. c. C. 265.

A shrub, 3 m. high or less. Leaves undivided or the lower ones slightly tricuspidate, mostly ovate, subcordate or cordate at the base, acute, 5–12 cm. long, 2·5–7 cm. broad, tomentose, especially on the lower surface. Sepals 4·5–8·5 mm. long, horn 0·2–0·5 mm. long. Stamens 8–10. Ovary 4-celled. Fruit 1–1·5 cm. in diameter including the prickles; prickles slender, pilose or nearly glabrous.

From the Upper Oubangui through Mittuland to Mombasa south to the Shire Highlands and Angola:—

Upper Oubangui; Krébdjé (Ft. Sibût), *Chevalier*, 5656! Balidga Country; Dar Banda, *Chevalier*, 6692! Mittuland; Mvolo, *Schweinfurth*, 2812! Uganda; Sibu, Nandi Country, *James*! between Nandi and Mumias, 1300–1800 m., *Whyte*! 5th march from Lubwas, *Whyte*! Busoga Gardens, *Whyte*! British East Africa; Mombasa, *Wakefield*! *Bojer*! Msilala, *Hannington*! German East Africa; Kilimanjaro, Marangu, everywhere in the bush, 1500–1900 m., *Volkens*, 1403! forest of Ngongongare, *Uhlig*, 520! Sakarre, on sunny borders of woods, up to 1300 m., *Busse*, 347! Usambara; among bracken, 1900 m., *Buchwald*, 374! Kwai, 1600 m., *Albers*, 153! at 1800 m., *Albers*, 253! Mlalo, on the slopes of low hills, *Holst*, 32! 644! Amani, on the way to the Sigi valley, *Braun in Bot. Inst. Amani*, 777!

Ukerewe, on the edge of a wood, *Uhlig*, 27! Karagwe; Kafuro, 1350 m., *Stuhlmann*, 1808! Ukamba; Kitu, *Hildebrandt*, 2769! forest on the Ugalla, *Böhm*, 112! 126! Zanzibar, *Kirk*! Angola: Huilla; in shrubby woods near the river Monino, *Welwitsch*, 1420! in grassy places at the Eme stream, *Welwitsch*, 1423! Bumbo; sporadic in damp wooded and shrubby places in Chao da Xella, *Welwitsch*, 1421! Mounyino, on the river-bank, 1760 m., *Dekindt*, 300!

Volkens states that the flowers are visited by Honey-suckers (*Nectarinia*).

According to Busse, the bark yields excellent bast for cordage.

Native names: "Sosokole"—*Busse & Albers*; "Fifiokolue"—*Albers*.

See Pl. **17**. fig. 5, fruit and prickle.

31. **T. Heudelotii**, Planch. ex Mast. in Oliver, Fl. Trop. Afr. i. 259 (1868).

Very like *T. tomentosa*, of which it may be only a form. It differs from typical *tomentosa* in the smaller fruits with stouter prickles, much broadened into the base.

Senegambia: *Heudelot*, 681!

32. **T. glechomoides**, Welw. ex Mast. in Oliver, Fl. Trop. Afr. i. 258 (1868); Hiern, Cat. Welw. Afr. Pl. i. 99 (1896).

Stems numerous, prostrate, about 2 mm. in diameter 30 cm. from the apex, arising from a woody rhizome; flowering branches erect. Leaves ovate, obtuse or rounded at the apex, cordate at the base, 3·5–7 cm. long, 2·5–5·5 cm. broad, crenate-serrate, 7–9-nerved at the base, sparingly setulose with simple appressed hairs or nearly glabrous on the upper surface, scabrid or scaberulous on the lower surface, mainly with stellate hairs. Cymes lax; pedicels about 0·5 mm. long. Sepals about 9 mm. long, setulose with simple or bifurcate hairs on the upper half, ciliate for 1 mm. at the base; horn 0·5 mm. long or less, terminated by a bristle. Glands suborbicular, distant. Stamens 10. Ovary 4-celled.

Angola: Huilla; in bushy woods between Monino and Eme stream, *Welwitsch*, 1409! Mounyino, creeping on sandy ground, 1760 m., *Dekindt*, 268! in herb-grown woods between Kaconda and Bissapa, *Gossweiler*, 4303!

33. **T. obtusicornis**, nob., sp. nov.

Rami ut videtur decumbentes, graciles (circiter 1 mm. diametro 15–30 cm. ab apice), parce stellato-pilosi. Folia ovata vel inferiora late elliptica, 2·5–4·5 cm. longa, 2–3 cm. lata, apice obtusa vel rotundata, basi rotundata, truncata vel subcordata, quinquenervia, nervis utrinque 2–3 præter basales, conspicue serrata serraturis alterne majoribus, in nervis utrinque stellato-puberula ceterum glabra, subtus conspicue reticulata; petioli 3–6 mm. longi, stellato-pilosi; stipulæ subulatæ, 4–6 mm. longæ. Cymæ in nodis superioribus plerumque binæ, trifloræ, bracteis 3 mm. longis. Sepala linearia, apice leviter cucullata, 8 mm. longa, 0·75 mm. lata, cornu 0·75 mm. longo. Petala oblanceolata, 7 mm. longa, 2·5 mm. lata, inferne 0·75 mm. ciliata. Gonophorum circiter 0·3 mm. longum, glandulis suborbicularibus. Discus annularis, 0·8 mm. longus, membranaceus, ciliatus. Stamina 8–10, 5–6 mm. longa. Ovarium 1·5 mm. longum setis inclusis, 2-loculare, setis spinula unica longa terminatis. Fructus maturus ignotus.

Branches apparently decumbent, about 1 mm. in diameter 15–30 cm. from the apex. Leaves broadly ovate or elliptic, obtuse or rounded at the apex, rounded or subcordate at the base, 3–4 cm. long, 2–2·7 cm. broad, serrate, 5-nerved at the base, or almost 7-nerved, sparsely stellate-puberulous on the nerves, otherwise glabrous. Sepals 8 mm. long, slightly cucullate at the apex, minutely stellate-pubescent outside; horn stout, obtuse, 0·75 mm. long. Gonophore much shorter than the disc. Stamens 8–10. Ovary 2-celled. Young fruit ellipsoid; prickles pilose.

Transvaal: near Middelburg, *Wilms*, 115!

34. **T. semitriloba**, Jacq. Enum. Pl. Carib. 22 (1760); Select. Stirp. Am. Hist. 147 (1763); DC. Prodr. i. 507 (1824); Mast. in Hook. f. Fl. Brit. Ind. i. 396 (1874); K. Schum. in Mart. Fl. Bras. xii. 3. 134 (1886).

Shrubby. Leaves acuminate, stellate-puberulous above, pubescent below, lower leaves suborbicular, pentagonal, cordate or truncate at the base, intermediate leaves 3-lobed, middle lobe much larger than the lateral ones, triangular or oblong, sometimes narrowed towards the base, upper leaves oblong, rounded or obtuse at the base. Buds 5–7 mm. long. Petals spathulate-linear. Gonophore, glands and ciliate disc present. Stamens 10–16. Ovary 3-celled (rarely 4-celled). Fruit subglobose, 1 cm. in diameter including the prickles; prickles 3–4 mm. long, uncinate, retrorsely pilose.

Mauritius: *Bouton*! *Bojer*!—A native of Tropical America.

35. **T. Lappula**, Linn. Sp. Pl. 444 (1753); DC. Prodr. i. 50 (1824).

Lower leaves 5-lobed, lobes short and broad; remaining leaves resembling those of *T. semitriloba*. Buds 3–4 mm. long. Petals, gonophore, glands and ciliate disc absent. Stamens 6–12, inserted immediately above the petals below a fleshy annular disc. Ovary 2-celled, cells divided by false septa. Fruit subglobose or ellipsoid, 5–7 mm. in diameter including the prickles; prickles 1·5–2·5 mm. long, uncinate, retrorsely pilose.

Cape Verde Islands: Ribeira da Furna; Sta. Catharina, *Lowe*! St. Jago: Valley of St. Domingo, *Hooker*, 191! Mauritius, *Bojer*!—Also in Tropical America.

See Pl. **17.** fig. 11, fruit and prickle.

36. **T. flavescens,** Hochst ex A. Rich. Tent. Fl. Abyss. i. 82 (1847); Mast. in Oliver, Fl. Trop. Afr. i. 255 (1868); K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 264 (1895).

T. monoica, Hochst. et Steud. ex A. Rich. Tent. Fl. Abyss. i. 82.

A shrub 2·4 m. high or less. Stems hirsute-pubescent or roughly pubescent. Leaves ovate-orbicular or suborbicular, rounded, truncate or cordate at the base, more or less acuminate to the apex, more or less angular, sometimes slightly trilobed, coarsely or finely doubly serrate, 7-nerved at the base, in a young state tomentose, afterwards becoming harshly pubescent on the upper surface. Stipules linear-lanceolate, acute, nearly 1 cm. long, densely hirsute outside. Buds tomentose or tomentellous. Stamens 20–22. Ovary 2–3-celled, cells divided by false septa. Fruit ovoid, stellate-pubescent; prickles incurved-ascending, stellate-pubescent, terminated by a single slightly falcate spinule or by several spinules.

From Arabia to German East Africa:—Arabia: Wadi Djara, *Ehrenberg*! Mt. Sidr, *G. Fischer*, 144! Mt. Sedder, *Schimper,* 761! Nubia: sea-coast about 21° E., *Bent*! Ssoturba Mts., Jebel Schellat, *Schweinfurth*, 2481! Eritrea: Haichello Kokob, north of Acrur, *Schweinfurth & Riva,* 155! Abyssinia: Dschadscha, 1500 m., *Schimper*, 102! near Mai Mezano, *Schimper* (sect. 3), 1442! Modat Prov., near Adeganna *Schimper* (sect. 2), 1020! in the mountains below Djeladjeranne, *Schimper* (sect. 3), 1794! plain of Hamedo, 1260 m., *Schimper*, 852! without precise locality, *Schimper*, 78! Ain, near Keren, *Steudner*, 1142! 1144! Habab, in shade, 2000 m., *Hildebrandt*, 540! 541! Gibba, *Rohlfs & Stecker*! Galla Highlands; Boran Country, Sidimum, *Ellenbeck,* 2240! Djehle, *Ellenbeck*, 2125! Somaliland and Harar: Kumbi, mountain plateau, about 1200 m., *Ellenbeck*, 1128! Somaliland: Widaba, *Miss Edith Cole*! British East Africa: Ukambani; near Kibwezi and Makindu, on sunny, dry, stony grass-steppe with scattered bushes, 1000 m., *Scheffler*, 33! Mto Ndei, *Scott Elliot*, 6210! Le, 1100 m., *Delamere*! Makindu River, *Kässner*, 576! German East Africa: near Dschalla Sea, 1000 m., *Volkens*, 1784! Grass-steppe below Marangu, *Volkens*, 2148! north-east end of Kidero Mt., *Jaeger*, 519! without precise locality, *Fischer*, 262! Masai-land: camp on the Ngare ol Osogwan River, *Merker*, 638! Masai steppe, about 1000 m., *Uhlig*, 351! Lake Kibibi, *Gregory*!

Schimper states that the flowers open about 3 o'clock in the afternoon, and are then visited by innumerable bees.

According to Scheffler, the flowers are much visited by a small beetle.

See Pl. **17**. fig. 8, fruit and prickle.

37. **T. trigona**, nob., sp. nov.

Frutex ramis teretibus furfuraceo-tomentellis pilis paucis patentibus simplicibus inspersis. Folia suborbicularia basi cordata, apice rotundata vel

obtusissima, 2·5–3 cm. diametro, crenulata, coriacea, utrinque dense tomentella, basi quinquenervia vel subseptemnervia, nervis supra prominulis subtus prominentibus, venulis supra occultis subtus prominulis; petioli 1–2 cm. longi, leviter sulcati; stipulæ caducæ. Inflorescentia terminalis, stricta, spiciformis, 20–30 cm. longa, foliis ad bracteas reductis; involucri bracteæ oblongo-ovatæ, obtusæ. Sepala linearia, apice cucullata, circiter 1 cm. longa, 0·75 mm. lata, extra furfuraceo-tomentella, superne verruculosa, appendice 1–1·5 mm. longo obtuso. Petala obovato-oblanceolata, basi attenuata, 8 mm. longa, 4 mm. lata, intus linea pilorum transversa circiter 1 mm. supra basin sita, extus inferne 1 mm. pubescentia. Glandulæ quadratæ, 0·5 mm. diametro, fere contiguæ. Discus circiter 0·5 mm. altus, breviter ciliatus. Stamina 26–29. Ovarium 3-loculare, loculis in locellos uniovulatos septo falso divisis. Fructus trigono-ovoideus, 7–8 mm. longus, 5 mm. diametro, ut aculei stellato-pubescens, aculeis incurvis 2–2·5 mm. longis, spinula unica leviter falcata terminali.

Stems scurfy-tomentellous. Leaves suborbicular, cordate at the base, rounded or very obtuse at the apex, crenulate, tomentellous. Stipules caducous. Inflorescence elongated, spike-like. Buds tomentellous. Sepals verruculose above. Stamens 26–29. Ovary 3-celled, cells divided by false septa. Fruit trigonous-ovoid, stellate-pubescent; prickles incurved-ascending, pubescent, terminated by a single falcate spinule.

Somaliland: Golis Range; Djedainio, *Miss Edith Cole*! *Mrs. Lort Phillips*! Wagga Mt., *Mrs. Lort Phillips*!

38. **T. benguelensis**, Wawra et Peyritsch, Sert. Beng. 19 (1860).

Undoubtedly distinct from *T. flavescens*, to which Masters, from description, reduced it. The chief differences are in the nature of the fruit and its prickles. A detailed description of the flowers is now given, to supplement that by Wawra and Peyritsch.

Sepala lineari-spathulata, superne cucullata, 9 mm. longa, inferne 1·2 mm. lata, medio 1 mm. lata, superne fere 2 mm. lata (explanata), cucullo ciliato, cornu subapicali 1·2–1·3 mm. longo. Petala obovato-spathulata, 7 mm. longa, 3 mm. lata, inferne 1·5 mm. ciliata, extra inferne 0·75 mm. pubescentia, intus inferne fere 1 mm. glabra, deinde 0·5 mm. pubescentia. Discus intus pubescens. Stamina 27–33. Ovarium 2–3-loculare, aculeis jam valde uncinatis. Fructus vel globosus, circiter 9 mm. diametro aculeis inclusis, vel minor, ovoideus.

An undershrub, 0·6–1 m. high. Stems roughly pubescent. Leaves broadly ovate or ovate-orbicular (in a young state suborbicular), cordate at the base, shortly acuminate or not, doubly serrate, 5–7-nerved at the base, tomentellous on both surfaces. Stipules lanceolate-subulate, 5 mm. long, stellate-pubescent outside, terminated by a bristle 0·5 mm. long. Buds densely tomentellous. Stamens 27–33. Ovary 2–3-celled. Fruit globose, 3-celled, or ovoid, 1–2-celled; body tomentose or densely pubescent; prickles spreading (the upper ones of the ovoid fruits ascending), stellate-pubescent near the base, almost glabrous above, terminated by a hooked spinule.

Angola: Benguella, amongst shrubs on the margins of woods, *Wawra*, 284!

39. **T. heterocarpa,** nob., sp. nov.

Frutex 0·5–1·5 m. altus, ramulis junioribus stellato-pubescentibus demum glabris. Folia suborbicularia vel subelliptica, basi obtuse cuneata, rotundata vel subcordata, apice rotundata vel subacuta, 1–3 cm. longa, 0·7–3 cm. lata, tenuiter coriacea, ± dupliciter crenato-serrata, discolora, basi quinquenervia, nervis supra inconspicuis subtus prominentibus, supra scabrido-pubescentia vel puberula, minutissime glanduloso-punctata, subtus tomentella vel dense pubescentia; petioli 0·7–3 cm. longi. Inflorescentia 7–13 cm. longa. Alabastra claviformia, juventute dense demum sparse pubescentia, matura in sicco 6–7 mm. longa, cornibus satis conspicuis patulis. Sepala spathulato-linearia, 7 mm. longa, 1–1·3 mm. lata; cornua 0·75–1 mm. longa. Glandulæ approximatæ, subquadratæ, 0·3–0·4 mm. diametro. Stamina 22–30. Ovarium 3-loculare. Fructus subglobosi vel ovoidei, usque ad 12 mm. diametro aculeis inclusis, corpore dense stellato-pubescente; aculei patuli, stellato-pubescentes, spinula unica uncinata vel falcata vel pluribus terminati.

A shrub 0·5–1·5 m. high. Stems at first pubescent, soon becoming glabrous. Leaves suborbicular or almost elliptic, obtusely cuneate, rounded or subcordate at the base, rounded or slightly acute at the apex, 1·3 cm. long, 0·7–3 cm. broad, thinly coriaceous, 5-nerved at the base, nerves prominent below, scabrid-pubescent or puberulous above, tomentellous or densely pubescent below. Mature buds sparingly pubescent. Stamens 22–30. Ovary 3-celled. Fruits globose or ovoid, densely stellate pubescent; prickles spreading, stellate-pubescent, terminated by a single uncinate or falcate spinule or by several spinules.

Abyssinia: Galla Highlands; Boran Country, Tarro Gumbi, *Ellenbeck*, 2082 *a*! Somaliland and Harar: valley of the Modji River, *Ellenbeck*, 1099 *b*! in thick bush on reddish-yellow loam, Gollaboda, *Ellenbeck*, 1188! Somaliland: Schebelli, *Donaldson Smith*! Turfa, *Donaldson Smith*!

Var. **glabrior,** nob.

Ramuli juniores puberuli tantum. Folia suborbicularia vel ovato-orbicularia, basi rotundata, truncata vel cordata, apice rotundata vel subacuta, 1·5–5 cm. diametro (in planta silvicola usque ad 11 cm. longa, 9·5 cm. lata), chartacea vel tenuiter coriacea, supra glabra vel glabriuscula, subtus glabriuscula vel cano-tomentella; petioli 1–3 (–5) cm. longi. Inflorescentia 7–25 cm. longa. Alabastra juventute stellato-puberula, demum glabriuscula, in sicco 5–6 mm. longa, cornibus conspicuis reflexis. Sepala spathulato-oblanceolata, 8 mm. longa, 1·5 mm. lata; cornua 1·5 mm. longa. Glandulæ distantes, ellipticæ, 0·4 mm. longæ. Stamina 30–38. Aculei glabriusculi, spinula unica uncinata terminati. Ceterum ut in typo.

Differs from the type in the nearly glabrous flower-buds with longer horns, and the almost glabrous prickles of the fruit.

Somaliland: Fullah Valley, between rocks on mountain-slopes, *Ellenbeck*, 234! Aroweyna, on stony ground, *Ellenbeck*, 406! Milmil, *Donaldson Smith*! Ogaden Country, *Robecchi Bricchetti*, 591! Somaliland and Harar: *Ellenbeck*, 1035! in thick forest on the banks of the river Gobelle, *Ellenbeck*, 1049! (a shade form).

Var. **rodriguesiana**, nob.—*T. glandulosa*, Balf. f. Bot. Rodrigues, 30, non Forsk.

Folia suborbicularia, basi obtuse cuneata, apice rotundata, 1–2·5 cm. diametro. Alabastra matura tomentella, in sicco 4–5 mm. longa, cornibus satis conspicuis patulis. Aculei fructus maturi puberuli, uncinati.

Differs from the type in the tomentellous flower-buds and the puberulous prickles.

Rodrigues: *Balfour*, 1075!

40. **T. rhomboidea**, Jacq. Enum. Pl. Carib. 22 (1760); Select. Stirp. Am. Hist. 147, t. 90 (1763); DC. Prodr. i. 507 (1824); Lindl. Collect. Bot. t. 29 (1821); Harv. in Harv. et Sond. Fl. Cap. i. 227 (1860); Mast. in Oliver, Fl. Trop. Afr. i. 257 (1868), partim; Mast. in Hook. f. Fl. Brit. Ind. i. 395 (1874); K. Schum. in Mart. Fl. Bras. xii. 3. 132 (1886).

Bartramia indica, Linn. Sp. Pl. 389 (1753).

T. Bartramia, Linn. Syst. ed. 10, 1044 (1759); Sp. Pl. ed. 2, 638 (1762); Willd. Sp. Pl. ii. 854 (1799); Roxb. Fl. Ind. ii. 463 (1832); Trimen, in Journ. Linn. Soc., Bot. xxiv. (1887) 141.

T. trilocularis, Roxb. Hort. Beng. 36 (1814); A. Rich. in Guill. & Perr. Fl. Seneg. 93 (1831); Roxb. Fl. Ind. ii. 462 (1832); F. N. Williams in Bull. Herb. Boiss. sér. 2, vii. (1907) 201.

T. mauritiana, Presl in Oken, Isis, xxi. (1828) 273.

T. velutina, Sieber ex Presl, l. c.

T. diversifolia, E. Mey. in Drège, Zwei Pfl. Docum. 227 (1843), nomen.

T. riparia, Hochst. in Flora, xxvii. (1844) 295.

T. effusa, J. M. Wood, Natal Plants (1902), t. 252, non E. Mey.

Vegetative members polymorphic. Hairs stellate. Flower-buds constricted in the middle. Sepals strongly cucullate above. Stamens 15, rarely fewer. Ovary 2–3-celled. Fruit globose or ovoid-globose, 4–5 mm. long or in diameter including the prickles; body densely tomentose; prickles uncinate, glabrous.

Distributed throughout the tropics.

The forms of *T. rhomboidea* are so numerous and varied that it is proposed to devote a separate paper to their elucidation. Typical *rhomboidea*, as represented by a specimen from Jacquin in the British Museum, has rhomboid-orbicular leaves, stellate-puberulous above, pubescent below; clavate buds, hardly 5 mm. long in a dried state, sparingly stellate-pubescent, and hardly horned.

It seems desirable to retain Jacquin's name in the meantime, although the earliest trivial is *indica* (1753), as there already exists a *Triumfetta indica* (Lam. Encyc. iii. 420), which may or may not be conspecific with *T. rhomboidea*. It is known to us only from the description.

41. **T. eriophlebia**, Hook. f. in Hook. Niger Fl. 235 (1849).

Sepala 5 mm. longa, extra papillata, setis paucis longis stellatis et simplicibus hirsuta, cucullo 0·75 mm. longo, margine superiore dense ciliato, cornu 1 mm. longo setas paucas gerente. Petala oblanceolata, 5 mm. longa, inferne 0·75 mm. dense ciliata. Stamina 15 (rarius 18), 4·5 mm. longa; filamenta superne incrassata. Ovarium 3-loculare, loculis septo falso divisis. Fructus globosus, 8–10 mm. diametro aculeis inclusis; aculei 2–3 mm. longi, uncinati, inferne longe dense setosi, superne glabri.

Stems densely or sparingly hirsute with simple hairs. Leaves ovate (the upper ones lanceolate), undivided or 3-lobed, obtuse or subtruncate at the base, acuminate to the apex, acute, sharply serrate, setulose with appressed simple hairs on both surfaces, hairs spreading at right angles to the nerves on the lower surface. Flower-buds constricted in the middle. Sepals papillate and sparingly setose outside, strongly cucullate above, upper margin densely ciliate. Stamens usually 15; filaments thickened above. Ovary 3-celled; cells with false septa. Fruit globose, 8–10 mm. in diameter including the prickles; prickles densely spreading-pilose below, glabrous above, uncinate.

Southern Nigeria: Benin Distr. (comm. *Imperial Institute*), 7! Owhy-Ikure, *Holland*, 217! Bakana, New Calabar, *Holland*, 145! Fernando Po, *Vogel*, 9! Old Calabar, *Robb*!

See Pl. **17.** fig. 7, fruit and prickle.

42. **T. pentandra**, A. Rich. in Guill. et Perr. Fl. Seneg. Tent. i. 93, t. 19 (1831).

T. neglecta, Wight et Arn. Prodr. Fl. Ind. i. 75 (1834); Mast. in Oliver, Fl. Trop. Afr. i. 255 (1868); Mast. in Hook. f. Fl. Brit. Ind. i. 396 (1874); Duthie, Fl. Upper Gangetic Plain, i. 119 (1903).

T. cuneata, Hochst. ex A. Rich. Tent. Fl. Abyss. i. 84 (1847).

Annual, 0·3–0·8 m. high. Stem stellate-scaberulous, the younger part often sparingly hirsute with simple hairs. Leaves rhomboid-orbicular, sometimes almost hexagonal, broadly cuneate or truncate at the base, acuminate to the apex, acute or subacute, undivided or more or less distinctly 3-lobed, the middle lobe considerably larger than the lateral, rather coarsely serrate, membranous or chartaceous, sparingly setulose mainly with appressed simple hairs, or puberulous above, stellate-pubescent below. Stipules subulate, 5–7 mm. long, hirsute. Flower-buds constricted in the middle. Sepals strongly cucullate above. Disc obsolete, or more or less developed. Stamens most frequently 5, sometimes 7–13. Ovary 2-celled, without false septa. Fruit ovoid; prickles ascending, uncinate, densely ciliate on the upper side, otherwise glabrous.

Cape Verde Islands and Senegambia to Abyssinia southward to Ngamiland and German South-West Africa :—

Cape Verde Islands : San Antonio, *Bolle* ! St. Jago ; rare, growing in the shade, valley of St. Domingo, *Hooker*, 177 ! without precise locality, *Lowe* ! St. Paul ; Ribeira das Pombas, *Lowe* ! Senegambia : margins of palm forests on Cape Verde Peninsula, *Perrotet,* 4 ! from the environs of Malka, *Roger* ! Galam, *Heudelot* ! Cayor ; Laybar, *Leprieur* ! Togoland : Sokodi-Basari, *Kersting,* 676 ! Soudan : Djenne, *Chevalier*, 3078 ! Djur-land : Great Seriba Ghattas, *Schweinfurth*, 2445 ! Kordofan : Wadi Asrak, *Pfund*, 316 ! Abyssinia : Djeladjeranne Distr., on rocks in the valleys at Mai-Mezano, *Schimper* (sect. 3), 1445 ! 1460 ! Modat Province, in narrow valleys, *Schimper,* 1756 ! Harar, Everthal, 1600 m., *Ellenbeck*, 854 ! from Tigré or Begemder, *Schimper* (a. 1863–8), 364 ! Togodele, *Ehrenberg* ! German East Africa : hill on the Tandangongoro Lake, about 250 m., in bushwood, *Busse*, 2485 ! Nyasaland, Nyika Plateau, *McClounie,* 161 ! Rhodesia : Boruma, *Menyhart*, 523 ! Ngamiland : Kwebe Hills, 990 m., *Mrs. E. J. Lugard*, 206 ! German South-West Africa : Amboland ; in the wood Ondonga, in the shade of trees, *Rautenen*, 42 !—Also in India and Formosa.

See Pl. **17.** fig. 9, fruit and prickle.

43. **T. annua**, Linn. Mant. i. 73 (1767); Sims, Bot. Mag. t. 2296 (1822); DC. Prodr. i. 507 (1824) ; Mast. in Oliver, Fl. Trop. Afr. i. 256 (1868) ; Szysz. Thalamifl. Rehmann. 150 (1887) ; K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 264 (1895) ; Hiern, Cat. Welw. Afr. Pl. i. 97 (1896).

T. triclada, Link, Enum. Hort. Berol. ii. 5 (1822).
T. trichoclada, DC. Prodr. i. 507 (1824).
T. nana, Bojer, Hort. Maurit. 43, sphalm. (1837).
T. Schimperi, Hochst. ex A. Rich. Fl. Abyss. i. 83 (1847).

Annual, 30–60 cm. high. Stems glabrescent below, very sparingly hirsute above with simple hairs, and with a single or two opposite lines of crispate pubescence. Leaves long petioled, rhomboid-orbicular or ovate (the upper ones lanceolate), acutely acuminate, coarsely serrate, membranous, sparingly setulose with simple hairs on both surfaces ; stipules spreading, subulate, hirsute. Flower-buds 2·5–4 mm. long. Sepals conspicuously horned, horns bearing one or more bristles. Stamens 4–11. Fruits depressed-globose, about 1·5 cm. in diameter including the prickles, 4-celled, perfectly glabrous, or the body and base of prickles inconspicuously pilose with long weak hairs (forma *piligera*) ; fruit-body honeycombed-reticulate, 3 mm. long, 7 mm. in diameter ; prickles about 60, 3–5 mm. long, uncinate, conspicuously broadened into the base, slightly flexuous especially in a young state.

From Abyssinia to Natal and the Transvaal, and in Angola, German South-West Africa, and Madagascar :—

Abyssinia : in the valley of the river Tacaze, near Djeladjeranne, *Schimper* (sect. 3), 1455 ! in bushy shady places in the middle of the Scholoda Mountains, *Schimper* (sect. 1), 368 ! Hamedo, 1380 m., *Schimper* (sect. 1), 369 (flowering specimens)! under the shade of trees near Gapdia, *Schimper* (sect. 2), 774! from Tigré or Begemder, *Schimper* (a. 1863–8), 366! without locality, *Quartin-Dillon & Petit*, 259! Nubia: Keren, *Steudner*, 1143! Uganda: Unyoro, in fields, *Speke & Grant*, 589! German East Africa: East Usambara; in coffee-plantations about 900 m., near Nguelo, *Engler*, 684! Lutindi, *Lubush*, 693! Marangu, frequent in banana-plantations, 1540 m., *Volkens*, 2307! Massai, *Fischer*, 57! Bukoba, *Stuhlmann*, 1558! Muansa, *Stuhlmann*, 4175! Amani, *Zimmerman*, 78! without precise locality, *Stuhlmann*, 2772! North Nyasaland, *Whyte*! (mixed with *T. trichocarpa*). N.W. Rhodesia: Livingstone, 900 m., in sand, *F. A. Rogers*, 7083! Angola: Pungo Andongo; rather rare in rocky thickets by Mata de Pungo, *Welwitsch*, 1407! Huilla; sparingly in rather open woods between Lopollo and Monino, *Welwitsch*, 1408! Mounyino, among bushes, 1760 m., *Dekindt*, 288! German South-West Africa: Okahandja, in shade of granite rocks, *Dinter*, 485! Natal: in Kafir garden, Great Noodsberg, 900 m., *J. M. Wood*, 4132! (forma *piligera*); without locality, *Gerrard*, 649! Transvaal: near Pretoria, close to the water, *J. W. C. Kirk*, 10! in stony places, near Sand loop, between Houtbosch and Pietersburg, *Bolus*, 10969! Madagascar: central region, *Baron*, 992! *Parker*! (both forma *piligera*).—Also in China, India and Malaya.

T. oblongata, Link (Enum. Hort. Berol. ii. 5), appears from description to be identical with *T. pilosa*, Roth. A specimen in the Berlin Herbarium, however, cultivated in the Botanic Garden, and named "*T. oblongata*, Link," is undoubted *annua*.

See Pl. **17.** fig. 10, fruit.

44. **T. trichocarpa**, Hochst. ex A. Rich. Tent. Fl. Abyss. i. 84 (1847); Engl. Hochgebirgsfl. Trop. Afr. 298 (1892); K. Schum. in Engl. Pflanzenw. Ost-Afr. C. 265 (1895)

Annual, 15–120 cm. high. Stem, leaves and flowers very like those of *T. annua*. Stamens 6–10. Fruit-body reticulate, puberulous; prickles about 120, not conspicuously broadened into the base, densely setose below, glabrous above.

Abyssinia to Nyasaland:—Abyssinia: in stony valleys at Mai Mezano, near Djeladjeranne, *Schimper* (sect. 3), 1682! 1683! near Gasta, *Schimper* (sect. 2), 1204! in half shade, Schahagenne, 1600 m., *Schimper* (a. 1863–8), 369! (fruiting specimen). German East Africa: Usagara; Tubugue, *Stuhlmann*, 216! Bukumbi, *Stuhlmann*, 806! Nyasaland: Shire Highlands; Blantyre, in woods, *Lawrence Scott*! North Nyasaland, *Whyte*! (mixed with *T. annua*); without precise locality, *Buchanan*, 379!

Var. **heteracantha**, nob.; aculei spinulis rectis solitariis vel pluribus stellatim dispositis terminati.

Chari: Mandjas Country; Nana Region, Gribingui, *Chevalier*, 6305!

45. **T. trachystema**, K. Schum. in Engl. Bot. Jahrb. xv. (1892) 130.

Branches puberulous, soon glabrous, with a single line of crispate pubescence in their upper parts. Leaves ovate-oblong, subcordate at the base, acutely acuminate, finely serrate, thinly coriaceous, quite glabrous on both surfaces. Inflorescence almost leafless. Flower-buds 4–5 mm. long. Sepals 5·5 mm. long, ciliate below for 0·75 mm., otherwise glabrous; horn 0·3 mm. long, tipped with a small caducous bristle. Glands transversely oblong. Stamens 10. Ovary 4-celled. Fruit glabrous.

Congo Free State: Baschilange Distr., *Pogge*, 611!

46. **T. scandens,** K. Schum. in Engl. Bot. Jahrb. xv. (1892) 125.

A climber, or when growing in the dry open savannahs, an erect shrub, according to Dr. Buchner. Stems glabrous (except when very young), covered with prominent, sharp, black tubercles. Leaves ovate, cordate at the base, acutely acuminate, serrate, almost glabrous above in the adult state, sparingly pubescent below, mostly with simple hairs (in a young state rough with small stellate hairs above, densely and roughly pubescent with both simple and stellate hairs below). Inflorescence leafy, 15–20 cm. long. Buds glabrescent, 7 mm. long in a dried state. Bracts lanceolate, acute. Stamens 10–12. Ovary 4-celled.

Angola: Malange District, *Buchner*, 127!

47. **T. cordifolia,** Guill. et Perr. Fl. Seneg. t. 18 (1831), sensu amplif., non descr.; Sprague in Kew Bull. 1908, 231.

T. semitriloba, Mast. in Oliver, Fl. Trop. Afr. i. 256, non Jacq.
T. semitriloba, var. *africana*, K. Schum. in Engl. Pfl. Ost-Afr. C. 264.

Var. **typica,** Sprague in Kew Bull. 1908, 231.

T. cordifolia, Guill. et Perr. l. c. sensu stricto.
T. longiseta, A. Rich. l. c.

Indumentum sparsum e pilis parvis stellatis plerumque constans; folia indivisa.

A shrub. Stems shortly stellate-pubescent or glabrescent. Leaves ovate, more or less cordate at the base, acuminate to the apex, irregularly serrate, 5–7-nerved at the base, chartaceous, stellate-puberulous on the upper surface, sparingly stellate-pubescent on the lower; petiole almost half as long as the leaf. Inflorescence not or scarcely leafy. Buds about 5 mm. long, pubescent (tomentellous in a young state). Horns of the sepals inconspicuous. Stamens 10–12. Ovary 4–5-celled. Fruits over 1 cm. in diameter including the prickles; prickles uncinate, pilose or more rarely glabrous.

Senegal: *Perrottet*, 3! 121! 122! *Farmar*! Senegambia: *Heudelot*, 629! Gambia: *Boteler*! *Ingram*! Casamance: Komboland, *Heudelot*! French Guinea: Kouria, *Chevalier*, 14968! Sierra Leone: *Afzelius*! *Smeathman*!

Don! *Dudgeon*! very common in open places near Sierra Leone, *Scott Elliot*, 4168! woods on way to Lester Peak, *Scott Elliot*, 3899! Scarcies, on the way to Kukuna, *Scott Elliot*, 4695! Bagroo River, *Mann*, 869! Liberia: near Monrovia, *Whyte*! Togoland: slopes of Agu Mt., above Nyambo, 350 m., *Busse*, 3356! Lagos: interior of W. Lagos, *Rowland*! Abeokuta, *Irving*, 76! (forma *hirsutisepala*). Southern Nigeria: Oloke Meji, *Foster*, 363! Chari: N'ayes, between Nguer and Bir (Tiolam), *Chevalier*! (no. 413,097! on separate ticket). Cameroons: forest to the north of Victoria, *Preuss*, 1356! (distributed as *T. semitriloba*, var. *kamerunensis*, K. Schum.). Bomana, 670 m., *Dusèn*, 308! Lupaka River, *Kässner*, 2444!

Var. **Hollandii**, Sprague, l. c.

Planta robustior. Caules pilis longis simplicibus hirsuti. Folia indivisa vel triloba.

Gold Coast: near Axim, *Cort Development Syndicate*! Arreboo, *Dudgeon*, ser. iii. 109! Togoland: Misahohe Station, a climbing shrub, 2–4 m. high, scattered throughout the bush savannah, *Baumann*, 306! Lagos: a herb 2 m. high, *Barter*, 20186! (forma *hirsutisepala*). *Millen*, 5! (forma *hirsutisepala*); interior of W. Lagos, *Rowland*! (Herb. Berol.). Southern Nigeria: Okimi, *Holland*, 170! Sapele, *Darker*! Fernando Po: a shrub, 3 m. high, *Barter*! Cameroons: on the way to Bonjongo, *Winkler*, 33 *b*! Buea, extremely common, *Deistel*, 514! Abonando; Ossidinge, on the Cross River, 90 m., in sunny places on old farms and villages, undershrub, 1–4 m. high, *Rudatis*, 93!

Native name "Esura"—*Millen.*

The following specimens show a transition to var. *tomentosa*: Gold Coast: Aburi Hills, *W. H. Johnson*, 476! Arreboo, *Dudgeon*, ser. iii. 109! Togoland: Bismarckburg, *Büttner*, 145! 233! Cameroons: Batanga, rather common in the open bush, *Bates*, 79!

Var. **tomentosa**, Sprague, l. c.

Folia plerumque suborbicularia, triloba vel subquinqueloba, utrinque dense stellato-tomentella.—*T. semitriloba*, Hiern, Cat. Afr. Pl. Welw. i. 97, non Jacq.

S. Nigeria: Old Calabar, *Milne*! Chari: Krebedje, *Chevalier*, 10651! Upper Ubangui; Ft. Sibut, *Chevalier*, 5708! Niamniam-land: on Boddo River, *Schweinfurth*, 2982! Cameroons: Duala, *Winkler*, 723! Ebea-falls, Lokundje, *Dinklage*, 305! Gross-Batanga, *Dinklage*, 913! Bipinde, *Zenker*, 1195! Yaunde, *Zenker*, 63! 676! Spanish Gaboon: Corisco Bay, Little Eloby Island, *Krause*! Congo Free State: *Christian Smith*! *Pogge*, 610! 615! Binguila, *Dupuis*! between Bolobo and Lukolele, *Büttner*, 170! Coquilhatville, *Schlechter*, 12611! Equateur District, *Pynaert*! Angola; Golungo Alto; *Welwitsch*, 1426! 1427! 1428! 4647! 4648! [for precise localities see Hiern, l. c.]. Lunda; between the rivers Luachimo and Guihumbo, *Marques*, 327! Also specimens from plants cultivated in the Royal Botanic Gardens, Kew, and the Royal Botanic Garden, Berlin.

48. **T. macrophylla**, K. Schum. in Engl. Bot. Jahrb. xv. (1892) 130; Engl. Pflanzenw. Ost-Afr. C. 265 (1892).

T. Telekii, Schweinf. in von Hoehnel, Zum Rudolf-See, Append. 15 (1892), nomen Engl. Hochgebirgsfl. 298, nomen.

An erect much-branched shrub, up to 2 m. high. Stems stout, fulvous or rufous-tomentose, not tubercled. Leaves acuminate, doubly crenate-serrate, coarsely pubescent above, tomentose below, the upper ones mostly ovate or lanceolate, rounded or subcordate at the base, the lower ones tricuspidate, up to 18 cm. long and 15 cm. broad, cordate at the base. Buds about 1·5 cm. long, tomentose, distinctly broader below. Horns of sepals usually inconspicuous. Stamens 12–25. Ovary 4–5-celled. Fruits 1·5–2 cm. in diameter including the prickles, black, glabrous or sparingly and very inconspicuously pilose.

Uganda: Entebbe, common in damp ground, *Mahon*! Victoria Nyanza; Berkeley Bay, *Scott Elliot*, 7087! Isole, South-West Creek, *Stuhlmann*, 870! Sesse Islands, *Stuhlmann*, 1488! in waste places, lake shore, Musozi, *Bagshawe*, 13! waste ground, *Wilson*, 59! British East Africa: Gaditu, *Kässner*, 887! German East Africa: Bukoba, *Stuhlmann*, 3213! Kilimanjaro; Lower Marangu, 1000–1500 m., *Meyer*, 14! Marangu Station, 1300–1560 m., frequent in light bush, *Volkens*, 599! at 2000 m., *H. H. Johnston*, 10! at 1650–2250 m., *von Hoehnel*, 130! 132! Chagga, *Rev. C. New in Herb. Kirk*, 13! Kabotschi, *Fischer*, 61!

Volkens 599 has conspicuous horns 1 mm. long or a little over, resembling *T. pilosa* in this respect. According to Volkens, the flowers open towards evening, and the honey is assiduously collected by Honey-suckers (*Nectarinia*).

Var. **ruwenzoriensis**, nob.—*T. brachyceras*, K. Schum. in Engl. Bot. Jahrb. xxviii. (1900) 432; *T. ruwenzoriensis*, Sprague in Journ. Linn. Soc., Bot. xxxvii. (1906) 503.

An erect bushy shrub, 1–2·5 m. high, or half-climbing, up to 6 m. Stems relatively slender, pubescent, soon glabrescent, not tubercled. Leaves acuminate, doubly crenate-serrate, sparingly pubescent or puberulous above with both simple and stellate hairs (*T. brachyceras*) or with stellate hairs only (*T. ruwenzoriensis*), pubescent below, the uppermost ones ovate or lanceolate, the lower tricuspidate, up to 13 cm. long and 9 cm. broad. Buds about 1 cm. long, tomentellous or pubescent, distinctly broader below. Horns of sepals usually inconspicuous. Stamens 10–12. Ovary 4–5-celled. Fruits about 2 cm. in diameter including the prickles, brown, glabrous.

Uganda: Mt. Ruwenzori, 2100 m. *Wollaston*! in forest, 1800–2700 m., *Scott Elliot*, 7660! at 1800 m., *Dawe*, 657! Ruchiga, *Bagshawe*, 429! British

East Africa: second day's march from Nandi, *Whyte*! between Nandi and Mumia's, 1300–1800 m., *Whyte*! Kikuyu, 1800–2550 m., *Battiscombe*, 27! Kenia Plains, *Hutchins*! German East Africa: Rugege Forest (Rukarara), 1900 m., *Mildbread*, 923! Uhehe; Utschungwe Mountain, on unwooded mountain-slopes, 2000 m., *Goetze*, 589! at 1600 m., *Mrs. Prince*! Usumbura, 2200 m., *Keil*, 17! Kilimanjaro, Kabotschi, *Merker*, 639!

Var. **Rothii**, nob.—*T. pilosa*, Mast. in Oliver, Fl. Trop. Afr. i. 257, partim, non Roth.

Like typical *macrophylla* in stem and leaves. Stamens 10. Fruits about 1·5 cm. in diameter including the prickles, rather densely pilose.

Abyssinia: Ankober, *Roth*, 52!

A specimen collected by Thomson in German East Africa on the lower plateau, north of Lake Nyasa, possibly belongs here. It is, however, much less hairy.

49. **T. pilosa**, Roth, Nov. Pl. Sp. 223 (1821); Mast. in Hook. f. Fl. Brit. Ind. i. 394 (1874).

T. oblongata, Link, Enum. Hort. Berol. ii. 5 (1822), e descr.

T. guazumæfolia, Bojer, in Bouton, Rapp. Ann. Maurice, xii. 18 (1842); et in Ann. Sc. Nat. sér. 2, xx. (1843) 101.

T. chrysotricha, Bojer, ll. cc. e descr.

Stems sparingly hirsute or glabrescent, minutely tubercled or not. Leaves ovate, rounded to cordate at the base, acutely acuminate to the apex, 5–12 cm. long, 3–7 cm. broad, rather coarsely serrate, puberulous or pubescent; petiole up to 5 cm. long, hirsute or glabrescent. Buds 9–12 m. long in a dried state, pubescent or hirsute-pubescent. Horns of the sepals inconspicuous. Fruits 1·5–2 cm. in diameter including the prickles, densely hirsute.

Madagascar: *Bojer*! *Humblot*, **243**! Ste. Marie, *Boivin*! Central Madagascar, *Baron*, 880! 1502! 1768! 3940! 4726! Betsileo-land, *Baron*, 80! Fort Dauphin, *Scott Elliot*, 2605!—Also in China, India, and the Malay Peninsula.

T. chrysotricha, Bojer, appears to be the hirsute form of *pilosa*, represented by *Baron*, 880.

Var. **tomentosa**, Szysz. Polypet. Thalamifl. Rehmann, 58 (1887), excl. syn.; ramis et alabastris tomentosis a typo recedit.

Shrub 1–2 m. high. Stems fulvous-tomentose. Leaves ovate (or the upper ones lanceolate), undivided or more rarely tricuspidate, rounded to cordate at the base, shortly acuminate to the apex, 6–12 cm. long, 3–7·5 cm. broad, serrate, coarsely pubescent above, tomentose or densely pubescent below; petiole hirsute-tomentose. Buds 7–8 mm. long in a dried state, hirsute-tomentose. Horns of sepals conspicuous. Ovary 4-celled. Fruits about 1·5 cm. in diameter including the prickles.

Transvaal: Shilouvane, *Junod*, 1030! Zululand, *Gerrard*, 152! Natal: between Pinetown and Umbilo, *Rehmann*, 8050! 8068! Inanda, *J. M. Wood*, 526! near Durban, *Marshall*! Umlazi River Heights, *Drège*! Coast lands, 0–300 m., *Sutherland*! Natal or Pondoland: between St. John's River and Umsikaba River, 300–600 m., *Drège*! Pondoland: in rocky ravines on Western Gate, Port St. John, 300 m., *Galpin*, 2893!

Var. **nyasana**, nob.; foliis lanceolatis plerumque grosse serratis et alabastris hirsuto-tomentosis distinguitur.—*T. morrumbalana*, De Wild. Pl. Herb. Hort. Then. t. 37, e descr. et icone.

An erect shrub, up to 2·4 m. high. Stem fulvous-hirsute with stellate hairs, hairs with conspicuous black tubercular bases. Leaves lanceolate, rounded or slightly cordate at the base, acutely acuminate to the apex, 9–18 cm. long, 2·5–7 cm. broad, coarsely serrate, roughly pubescent on the upper surface, more densely pubescent on the lower; petioles hirsute, 1·5–4·5 cm. long. Buds about 9 mm. long in a dried state, densely hirsute or tomentose. Horns of sepals conspicuous. Ovary 3–4-celled. Ripe fruits not known.

British East Africa: near Nairobi, *Whyte*! Nyasaland: Masuku Plateau, 1950–2100 m., *Whyte*! Namasi, *Cameron*, 21! Shire Highlands, in wet soil, *Buchanan*, 380! 381! Specimens from Rhodesia: Melsetter District; Yungunyana, *W. H. Johnson*, 120! and near Chirinda, *Swynnerton*, 271! come near var. *nyasana*.

Var. **glabrescens**, nob.; a var. *nyasana* alabastris sparse pilosis et foliis pro rata angustioribus recedit.

Much more glabrous than var. *nyasana*. Leaves oblong-lanceolate, more rarely lanceolate, 8–14 cm. long, 1·5–3·5 cm. broad. Buds 6–9 mm. long in a dried state, rather sparingly stellate-pilose. Horns of the sepals conspicuous. Ovary 3–4-celled. Ripe fruits up to 2·7 cm. in diameter including the prickles.

German East Africa: Usambara; M'lalo, *Holst*, 642! Nyasaland: without precise locality, *Buchanan*, 726! Between M'pata and the commencement of the Tanganyika Plateau, 600–900 m., *Whyte*! Nyika Mts., 1200–1800 m., *Whyte*! Mt. Chiradzulu, *Whyte*!

See Pl. **17.** fig. 12, fruit and prickle.

Forma **tricuspidata**, nob.; foliis ambitu ellipticis acute tricuspidatis basi cordatis differt.

Abyssinia: Galla Country; near Sheikh-Huzein, 1700 m., *Ellenbeck*, 1250!

50. **T. effusa**, E. Mey. ex Harv. in Harv. et Sond. Fl. Cap. i. 228 (1860); Szysz. Polypet. Thalamifl. Rehmann, 59 (1887).

T. rhomboidea, var. *tomentosa*, Szysz. Polypet. Thalamifl. Rehmann, 59 (1887).
T. pseudorhomboides, Szysz. l. c.
T. pilosa, J. M. Wood, Natal Plants, t. 318, quoad iconem, non Roth.

Shrub. Stem roughly stellate-pilose; rays of the stellate hairs spreading, bases minutely tubercular. Leaves ovate, tricuspidate or undivided, or lanceolate, rather coarsely and irregularly serrate, rounded or slightly cordate at the base, shortly acuminate to the apex, 4–13 cm. long, 2–8 cm. broad, roughly stellate-pubescent on both surfaces, more densely on the lower; petioles 1–4·5 cm. long. Buds 7–8 mm. long in a dried state, rather densely stellate-pilose. Horns of the sepals conspicuous. Stamens 10. Ovary 3–5-celled. Ripe fruit up to 1·5 cm. in diameter including the prickles, black, glabrous, or sparingly and very inconspicuously pilose.

Rhodesia: near Chirinda, 1100 m., *Swynnerton*, 1156! Transvaal: Shilouvane, *Junod*, 1052! on river-banks near the town of Lydenburg, *Wilms*, 100! Houtbosch, *Rehmann*, 6317! 6318! 6319! Natal: near Durban, *Gerrard*, 469! without special locality, *Williamson*! Natal or Pondoland: between Umtentu River and Umzimkulu River, below 150 m., *Drege*! wood clearings on the lower Umzimkulu, *Bachmann*, 867! 869! Pondoland; near the St. John's River, *Bolus*, 8811!

Rehmann's 6317, 6318, and 6319 differ but slightly from one another, and it is difficult to understand how Szyszylowicz came to place them in three distinct species. Possibly the erroneous description by Harvey (Fl. Cap. i. 228) of the fruit of *T. effusa* as "hispid" may have misled him.

Var. **leiocalyx**, nob.; a typo foliis utrinque sparse pilosis tantum, alabastris glabris vel superne sparse stellato-puberulis.

Natal: Pinetown, *J. M. Wood*, 254! Cape Colony, Rooi Vaal, mouth of the Kei River, *Flanagan*, 456!

SPECIES EXCLUSA.

T. Junodii, Schinz in Mém. Herb. Boiss. no. 10, 49 (1900) = **Corchorus Junodii**, N. E. Br. in Kew Bull. 1908, 287.

SPECIES MINUS NOTA, A NOBIS NON VISA.

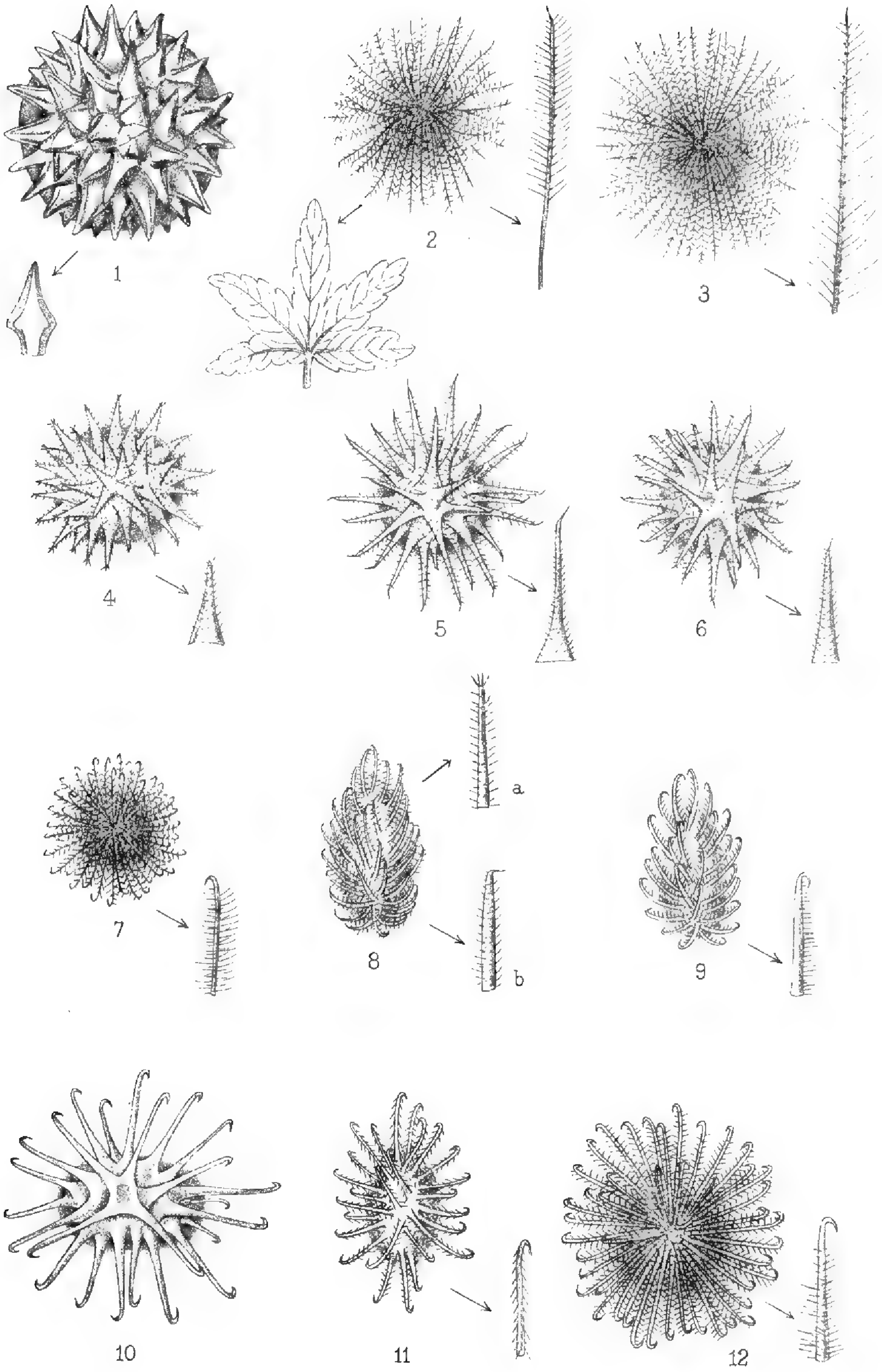
T. holosericea, Schinz in Bull. Herb. Boiss. sér. 2, viii. (1908) 702.

EXPLANATION OF PLATE 17.

Fig. 1. *Triumfetta amuletum*, fruit (nat. size) and tubercle (× 1½).
2. „ *Kirkii*, fruit (× 1½), leaf (nat. size) and bristle (× 4½).
3. „ *Sonderii*, fruit (nat. size) and bristle (× 3).
4. „ *buettneriacea*, fruit (× 2½) and prickle (× 3).
5. „ *tomentosa*, fruit (× 2¼) and prickle (× 3).
6. „ *procumbens*, fruit (× 1¼) and prickle (× 2½).
7. „ *eriophlebia*, fruit (× 2) and prickle (× 3).
8. „ *flavescens*, fruit (× 2¼) and prickle (× 4).
9. „ *pentandra*, fruit (× 2½) and prickle (× 4).
10. „ *annua*, fruit (× 2¼).
11. „ *Lappula*, fruit (× 2½) and prickle (× 3½).
12. „ *pilosa*, fruit (× 1¼) and prickle (× 2).

Note.—To avoid confusion, the prickles have been represented in a semi-diagrammatic manner.

Sprague & Hutchinson. Journ Linn. Soc. Bot. Vol. XXXIX. Pl. 17.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THE JOURNAL

OF

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On *Calamites Schützei*, Stur, and on the Correspondence between some new features observed in *Calamites* and Equisetaceæ.

By A. R. HORWOOD (Leicester Museum). (Communicated by E. E. LOWE, F.L.S.)

(PLATES **18** & **19** and 1 Text-figure.)

[Read 3rd June, 1909.]

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I. *Introductory remarks.*

WHILST engaged in the examination of the Fossil Flora of the Leicestershire and South Derbyshire Coalfield *, the writer was favoured by Mr. R. Emmerson, of the Ellistown Colliery, near Leicester, with a specimen of *Calamites* (*Calamitina*) *Schützei*, Stur, found in close proximity to the Main Coal. The specimen is now in the Leicester Museum. It presents two characters not usually seen in pith-casts, viz.: a hollow stem †, and a regular succession of uniformly increasing internodes, with a marked recurrence of a short internode. A comparison with recent *Equiseta* shows that this last feature is common also, with some modifications, to the latter group.

---

* Fox-Strangways, C., and A. R. Horwood: "The Geology of the Leicestershire and S. Derbyshire Coalfield," Mem. Geol. Surv. 1907, pp. 114–141.

† The peculiarity of this is that, as the diagram shows, it affords graphic proof of the fistular nature of the pith.

I A. *Description of specimen demonstrating the fistular character of the pith in* Calamites.

The specimen from Stanton-under-Bardon is split, 3 inches from the base, firstly in a longitudinal direction, and is 3½ inches apart at the upper extremity. Fourteen inches from the last point the left-hand fork thus formed is split again for a length of 12 inches, and at its base is 2½ inches from the main portion. Split thus in two *opposite* directions the specimen (a pith-cast) affords a graphic demonstration of the fistular character of the pith.

The fact that pith-casts are filled with mud is in itself a proof of the same kind. Originally the now solid centre was hollow. *Calamites* is more often than not, moreover, found as medullary or pith-casts *. The markings on their surface merely represent the internal impressions of medullary rays and woody wedges seen in some specimens as a thin carbon-crust. In young stems, where a pith is found, these casts do not occur, but in old specimens these features are represented by the "ridge" and "furrow" of the pith-cast. In these cases, according to Williamson †, the pith has been absorbed or resorbed by "a vital process" and not by decay.

The casts usually found are oval or circular in section, filled with mud, shale, etc., flattened or compressed by pressure and other causes. There may or may not be an external carbon-crust, due to mode of preservation, character of the sediment or waters. Owing to these reasons it is difficult to correlate the different form-genera that have been made for fragments of root, stem, foliage, and fructification.

Though the hollow character of the pith has long been known, no clear figure has been published to prove this as in the accompanying illustration (Plate **18**). Lindley and Hutton ‡ figured a crushed example, which "has been struck perpendicularly so as to separate it into many portions." Their figure (¾ nat. size) represents a stem split into about ten fragments spread out horizontally in a verticillate manner.

The Stanton-under-Bardon specimen is three inches in width at the base, and at the upper extremity the fractured portions together amount to the same.

The specimen now figured throws some light upon a figure of a specimen in the 'Fossil Flora' referred to *Calamites Mougeotii* by Lindley and Hutton §. What are there regarded as attenuated terminations are simply portions of a stem that has been split.

---

* An unusually fine specimen showing the pith-cast and woody cylinder of *Calamitina approximata* in Dr. Kidston's collection is figured by Prof. Seward ('Fossil Plants,' vol. i. fig. 100).

† Phil. Trans. Roy. Soc. 1871, p. 494.

‡ Fossil Flora, vol. i. pl. 21.

§ *L. c.* vol. i., explanation of plate 22, p. 72.

I B. *Remarks on the fistular pith-cavity of* Calamites.

On their figure of a specimen referred to *Calamites inequalis*, Lindley and Hutton* remark that "the specimens confirm the opinion that *Calamites* were hollow. The cylinder that once was of vegetable matter has altogether a different texture from the interior, which is a coarse grit that separates freely from the stem itself." The confirmation merely rests upon the presence of a carbon crust, which is usual where preservation has been in shales, not sandstones.

Many previous observers had figured casts, *e. g.* Scheuchzer, Volkmann, J. Woodward, C. F. Schulze, Suckow. Schulze even compared the specimens with Equisetaceæ. Suckow, author of the genus (1784), regarded them as casts, and compares them with *Equisetum maximum.* Steinhauer, in 1818, figures casts, and Artis, in 1825, represents others in his 'Antediluvian Phytology.' Brongniart, in 1822, compares *Calamites* with *Equisetum*; and in his 'Histoire des végétaux fossiles,' 1828, figures and describes many of the species now recognized. Thus Suckow paved the way for a correct conception of their nature, which was later extended and improved by Dawes †, and in more recent times by the masterly work of Williamson, Scott, and others.

II A. *Description of specimens of* Calamites *with recurring short internodes, etc.*

The following measurements (Table I.) of the specimen of *Calamites Schützei* from Stanton-under-Bardon give in tabular form an idea of the regularity of the increase of internodes in length and uniformity of the short internode. The total length is 3 feet, width where split and where unsplit 3 inches.

In another specimen from Brighouse, near Halifax, Yorkshire (Plate **19**), the length is 2 ft. 9 ins., and the average width 2¾ ins. Its measurements are given below (Table II.).

In the former case there are 21 internodes, of which the first and last may not be complete. They may be divided into 3 complete periods. There is a noticeable increase, regular and gradual, in each period commencing at the smallest internode. At the end of each period branches were borne, indications of which may be seen in the specimen.

Below each node infranodal canals may be seen.

The most striking feature is the uniform length (1·6 to 1·9 cm.) and position of the short internode at the commencement of each period. Again, internode B ranges from 3·5 to 4 cm., C from 4·7 to 5·7 cm., D from 5·2 to 8·2 cm., and E from 5·5 to 7·1 cm. Thus there is a general uniformity in length.

---

* Fossil Flora, vol. iii. 1837, pl. 176.

† Quart. Journ. Geol. Soc. 1849, pp. 30–31; *ibid* 1851, pp. 196–99.

Table I.

Number.	Position upon the stem.	Length in centimetres.	Period.
C	1st internode from the base.	4·7	Incomplete. I.
D	2nd ,, ,,	7·8	
E	3rd ,, ,,	6·3	
A	4th ,, ,,	1·6 to 1·9	Complete. II.
B	5th ,, ,,	3·5 to 3·8	
C	6th ,, ,,	5·2	
D	7th ,, ,,	5·2	
E	8th ,, ,,	5·5	
A	9th ,, ,,	1·9	Complete. III.
B	10th ,, ,,	4·1	
C	11th ,, ,,	5·2	
D	12th ,, ,,	5·8	
E	13th ,, ,,	7·1	
A	14th ,, ,,	1·9	Complete. IV.
B	15th ,, ,,	4·0	
C	16th ,, ,,	5·7	
D	17th ,, ,,	8·2	
A	18th ,, ,,	1·9	Incomplete. V.
B	19th ,, ,,	3·8	
C	20th ,, ,,	5·2	
D	21st ,, ,,	5·2	

Table II.

Number.	Position upon the stem.	Length in centimetres.	Period.
D or E	1st internode from the base.	7·3	Incomplete. I.
A	2nd ,, ,,	3	Complete. II.
B	3rd ,, ,,	5	
C	4th ,, ,,	4·7	
D	5th ,, ,,	5	
E	6th ,, ,,	6·3	
A	7th ,, ,,	3	Complete. III.
B	8th ,, ,,	5·2	
C	9th ,, ,,	4·5	
D	10th ,, ,,	6·3	
A	11th ,, ,,	3	Complete. IV.
B	12th ,, ,,	5·7	
C	13th ,, ,,	4·5	
D	14th ,, ,,	5·7	
A	15th ,, ,,	3	? Complete. V.
B	16th ,, ,,	5·1	
C	17th ,, ,,	3·5	
D	18th ,, ,,	3·5	

Node A (the short internode) appears to serve the purpose of imparting additional strength to the stem owing to the weight of branches above. The same feature will be noticed in recent *Equiseta.* The specimen, as is usual in this species, is covered with carbonaceous matter.

The specimen from Brighouse, Yorkshire, provisionally referred to this species is a stem 2 ft. 9 ins. long, somewhat arched, being possibly an upper portion of a subterranean stem, having grown out at an angle. There are 18 internodes devoid of a carbon-crust, with only here and there traces of branch-scars. It exhibits the same features as the Stanton-under-Bardon specimen, there being a uniform increase in length and a regular succession of short internodes. The tables of measurements of the two taken together afford an interesting means of comparison with those of recent *Equiseta.*

Brief reference may be made to previously published measurements of other specimens of *Calamites.*

In the 'Fossil Flora,' Lindley and Hutton * figure a specimen referred to *Calamites approximatus,* Sternberg (= *C. Schützei,* Stur), with 12–13 short internodes, followed by six increasing regularly in length. The former are abnormal, and due possibly to remarkable strain and need of extra strength. Otherwise it is intermediate between *Calamitina* and *Eucalamites.*

In his memoir on the South Wales Coalfield Dr. Kidston figures † an interesting specimen of *Calamites* (*Calamitina*) *varians,* Sternb., var. *insignis,* Weiss. In length it is 321·50 mm., and contains two complete and three incomplete periods, with forty internodes, and a short internode precedes each branch-bearing node.

In his memoir on the Somerset Coalfield also Dr. Kidston figures ‡ a specimen of *Calamites* (*Eucalamites*) *senarius,* Weiss. It is 36·7 cm. long with 18 internodes, and 6 branch-scars are seen. It exhibits the same uniformity in length of internodes with gradual increase in each period noticed in the specimens here under notice.

Professor Seward gives measurements § of internodes of specimens of *Calamites* (*Calamitina*) *undulata,* Sternb.

In his memoir on *Calamites* ‖ Prof. Williamson mentions the occurrence of this short internode, but finds no reason for its constant recurrence or significance. Referring to a specimen of Mr. Wilde's (pl. 27. fig. 29), he says ;—"The drawing is of natural size. In the two lowermost internodes (k, k') and to a large extent in the uppermost one (k'), the longitudinal grooves are regularly parallel with each other and, like the internodes themselves, uniform in size ; but in the shorter internode (k'') this is not the case.

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* Vol. i. pl. 77.

† Trans. Roy. Soc. Edinb. vol. xxxv. pt. ii. no. 10 (1889), pl. 1. fig. 1.

‡ *Ibid.* vol. xxxiii. pt. ii. (1887) pp. 340–1.

§ Geol. Mag. 1888, p. 2.

‖ Phil. Trans. Roy. Soc. 1871, pp. 495–6.

Pl. 27. fig. 30 represents a few of the ridges and furrows of the latter enlarged about three diameters. Some of them are much thicker at one end than at the other, whilst there are few in which the two sides are quite parallel. But beside this peculiarity the internode itself is unlike its neighbours, being only about half their length. Were this all, the internode might be regarded as an accidental anomaly; but when phenomena appear in regularly recurring series such an explanation is inapplicable. In Mr. Wilde's fine specimen, of which fig. 29 represents a very small portion, every *eighth* internode exhibits these peculiarities. Similar appearances are seen in another specimen in the same collection, but here they appear in every *fifth* internode. I have as yet failed to correlate these appearances of the medullary cast with any known external features of *Calamites*, but that they have some special significance cannot be doubted. They most probably indicate some *specific* * features of the plant to which they belonged."

Thus Williamson, in 1871, anticipates Weiss's characters given to subgenera founded in 1876. It is a fair inference that we may make, seeing the short internode is so repeatedly associated in *Calamites*, and also in recent *Equiseta*, with branch-bearing internodes, that it has a physiological function, viz.: to impart strength to the stem. Its position indicates the introduction of a new series of organs, since, as we shall see, it follows or precedes the root-bearing stem and barren stem, and precedes or follows the branch-bearing internodes and strobili.

When thus considered physiologically, this gradual increase in length of internodes (and leaf-sheaths) upwards in living *Equiseta* entirely depends upon the laws of growth, elongation following cell-growth, with a proper supply of water; and is in accord with general principles.

And in this connection Strasburger † sums up as follows:—"As is often observed with the occurrence of many vital phenomena, *the rate of distension of the walls with the inflation water is not uniform, but begins slowly, increases to a maximum rapidly, and then gradually diminishing altogether ceases.*"

II B. *Description of specimens of recent* Equiseta *in which short internodes occur as in the extinct* Calamarieæ, *with proportionally regular increase in length.*

It is an interesting fact, brought out by a study of the fossil forms here described, that during the progress of the investigation recent *Equiseta* were examined and found to possess the same peculiarities as *Calamites*, in the possession of a short internode and a uniform rate of increase in length. Thus characters typical of the subgenus *Calamitina* occur also in a modified form in subterranean stems of *Stylocalamites Suckovii* (Brongn.), and indications of this are found in *Equisetum*. In *Eucalamites*, where short internodes with branches are successive, there is a modification of the features met with in the other subgenera[*]. The following measurements of specimens of *Equisetum arvense*, L., collected at Lowesby, Leicestershire, on May 15th, 1908, serve to indicate how fertile stems exhibit these characters:—

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* Present writer's italics.

† 'Text-book of Botany' (English Edition), 1903.

TABLE III.

Specimen.	Internode **1.**	Int. **2.**	Int. **3.**	Int. **4.**	Int. **5.**	Int. **6.**	Int. **7.**	Int. **8.**	Total length.
A	·5	1·5	2	2·2	2·7	2·5	..	..	15 cm.
B	·5	1·5	2·5	3	3·8	3·8	..	..	18 cm.
C	·8	1·5	2	2·5	2·3	2·2	2·5	2·1	20 cm.
D	(?)·5	1·4	2	2·2	2·5	3	2	..	16·5 cm.
E	·5	1·5	1·9	2·4	3	3·8	3·4	..	19·5 cm.
F	·5	1·5	2·2	3	3·3	3·2	..	..	16·5 cm.

The uniformity in the length of leaf-sheath also is further illustrated in the subjoined table:—

TABLE IV.

Specimen.	Int. **1.**	Int. **2.**	Int. **3.**	Int. **4.**	Int. **5.**	Int. **6.**	Int. **7.**	Int. **8.**	Int. **9.**	Int. **10.**
A	1	1	1·3	1·4	1·5					
B	1·3	1	1·3	1·5	1·6					
C†	·5	·8	1	1	1	1·2	1·3	1·5	1·6	1·6+
D	·7	·8	1·1	1·3	1·5	1·6				
E‡	·6	·7	·9	1	1·2	1·4	1·6	1·9		
F	·7	1	1·2	1·4	1·6	1·8				

In the two foregoing tables the first internode is remarkably uniform, ·5 cm. (or in one case ·8 cm.). In D, where it is doubtful, basal leaf-sheaths overlap.

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[*] In all three subgenera the strength-imparting function may reasonably be predicated as explanatory of the position of the short internode.

[†] The first three leaf-sheaths overlap.
[‡] The first two leaf-sheaths overlap.
Owing to this the measurements where indicated are somewhat uncertain.

The second internode again in all but one case (where it is 1·4 cm.) is 1·5 cm. The third varies from 1·9 to 2·5 cm., the fourth from 2·2 to 3 cm., and so on. Thus in these six specimens gathered at random the two points remarked in the extinct *Calamitina Schützei,* Stur, are also to be seen, viz., uniform length and position of a short internode, and gradual uniform increase in the length of succeeding internodes, from below upwards. The same remarks as to increase apply equally to the leaf-sheaths, and though amongst *Calamites* we have no chance of comparing them, yet in *Equisetites* they are usually quite as uniform*. Not only is it remarkable to find these characters common to Carboniferous and present day groups of the same genetic series, but it may further be found to obtain generally in living *Equiseta* amongst species living under very varied conditions with diverse habit. The table on p. 285 illustrates this fact. Thus these characters serve as a further means of tracing to a common origin the extinct Calamarieæ and the living Equisetaceæ, now grouped together in a common phylum Equisetales.

In *Equisetum maximum,* Lam., in *branching* stems a gradual decrease in the length of internodes upwards, the largest at the base, takes place, whereas in *fertile* stems the converse holds, except in the case of the short internode preceding a cone. When a stem bears both cones and branches the two modes of elongation alternate. This is seen in *E. pratense,* Ehrh. In *E. sylvaticum,* Linn., the same feature is noticed in specimen A † and in C, but in B, in the branching period, there is an increase and then a decrease, three sheaths overlapping. In D the internodes increase up to the node preceding the branch-bearing node, then an internode doubtfully shorter intervenes, followed by a regular decrease in length upwards.

In the var. *capillare* the elongation is as in A and C of the type. The hybrid between *Equisetum arvense* and *E. limosum* (*E. litorale*) exhibits a little variation, two internodes before the branch-bearing node decreasing, not one, but the eighteen succeeding internodes exhibit a remarkably uniform normal decrease at the rate of 1 millimetre approximately. In *E. limosum,* Linn., var. *fluviatile* (Linn., sp.), the internode before the branch-bearing node is not shorter than the penultimate one. But after this the length of the internodes decreases from the second member of the branch-bearing period. In *E. hyemale,* L., there is a gradual increase in length up to the last one, but as the specimen is incomplete it does not serve for comparison.

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* Where any abnormal variation in length occurs either in the internodes or the leaf-sheaths it may be reasonably regarded as due to variation in the external conditions or environment, amount of light, moisture, etc.

† In internode 10 there is an abnormal increase, otherwise the sequence is normal.

TABLE V.

GENERA AND SPECIES.	LENGTH OF INTERNODES IN CENTIMETRES.																							REMARKS.
	1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**	**19.**	**20.**	**21.**	**22.**	**23.**	
I. *Equisetum maximum*, Lam.	4·2	(?) 3·9	(?)3·6	3·5	3·3	2·8	2·4	2	1·7	1·5	1·3	1	·9	·8	·8	·7	·7	8	1	...	...	...	...	Barren stem. Ely, Cambs.
,, ,,	1·4	1·9	2·3	2·7	4·2	4·2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	Fertile stem. Ely, Cambs.
,, *pratense*, Ehrh.	(?) ·5	1·1	1·8	2·3	3	3·1	3·2	*3·1	2·7	2·2	2	1·8	1·5	...	...	...	...	...	...	...	...	...	...	Specimen A. Quoy's Bay, Hoy, Orkney.
,, ,,	2 over- sheaths	lapping †	·8	1·3	1·7	2·1	2·3	2·3	2·3	*2·1	2	1·9	1·7	1·5	1·2	·9	·6	·6	...	...	...	...	...	Specimen B. Quoy's Bay, Hoy, Orkney.
II. *Equisetum sylvaticum*, Lam.	2·3	3·2	(?)3·7	3·9	*3·9	3·7	3·5	3·4	3·5	3·7	2·4	...	...	...	...	...	...	...	...	...	...	...	...	Fertile and branch-bearing stem A. Norwood, Yorks.
,, ,,	(?)1·6	2·4	3·4	2·3	3 over- sheaths	lapping 2·8	leaf- between †	†4·1	*5·2	6·1	4·9	...	...	...	...	...	...	...	...	...	...	...	...	Fertile and branch-bearing stem B. Norwood, Yorks.
,, ,,	1·8	2·1	2·2	2·2	2·1	*1·9	1·8	1·6	1·3	1·1	·9	·6	...	...	...	...	...	...	...	...	...	...	...	Barren stem C. Fansley, Northants.
,, ,,	1	1·7	3	4	4·5	4·8	4·5	*(?)4·2	4	4	3·6	2·4	2·1	1·9	1·8	1·5	1·3	1	·4	·3	...	...	...	Barren stem D. Gracedieu, Leicestershire.
,, ,, var. *capillare* (Hoffm.)	·7†	(?)·7†	(?)·8†	2	2·6	3·3	3·5	3·7	3·8	*3·8	3·6	3·3	2·5	2·1	1·8	1·3	·9	·8	·8	·7	·6	·5	·5	Harthill, Cheshire.
III. *Equisetum litorale*, Kühlew.	2·7	2·9	2·9†	2·8	2·7	*2·5	2·4	2·3	1·9	1·8	1·6	1·4	1·2	1·1	·9	(?)·8	·6	·5+·5		·4+·4		·3	†Two over-lapping sheaths.	Barren stem. Dulverton, S. Somerset.
,, *limosum*, var. *fluviatile* (Linn., sp.).	·5†	1·8	1·8	2·1	2·4	2·9	3	2	3·6	3·7	*3·8	4·4	3·7	2·8	...	...	...	...	...	...	...	...	...	Fertile stem. River Soar, Aylestone, Leics.
Equisetum hyemale, Linn.	‡ Incom	plete.	3·4	5	6	6·4	6·8	6·7	6·2	‡ Inc	ompl	ete.	...	...	...	...	...	...	...	...	...	...	...	Gracedieu Wood, Leics.

* An asterisk denotes that a branch-bearing node immediately precedes the internode to which it is prefixed.

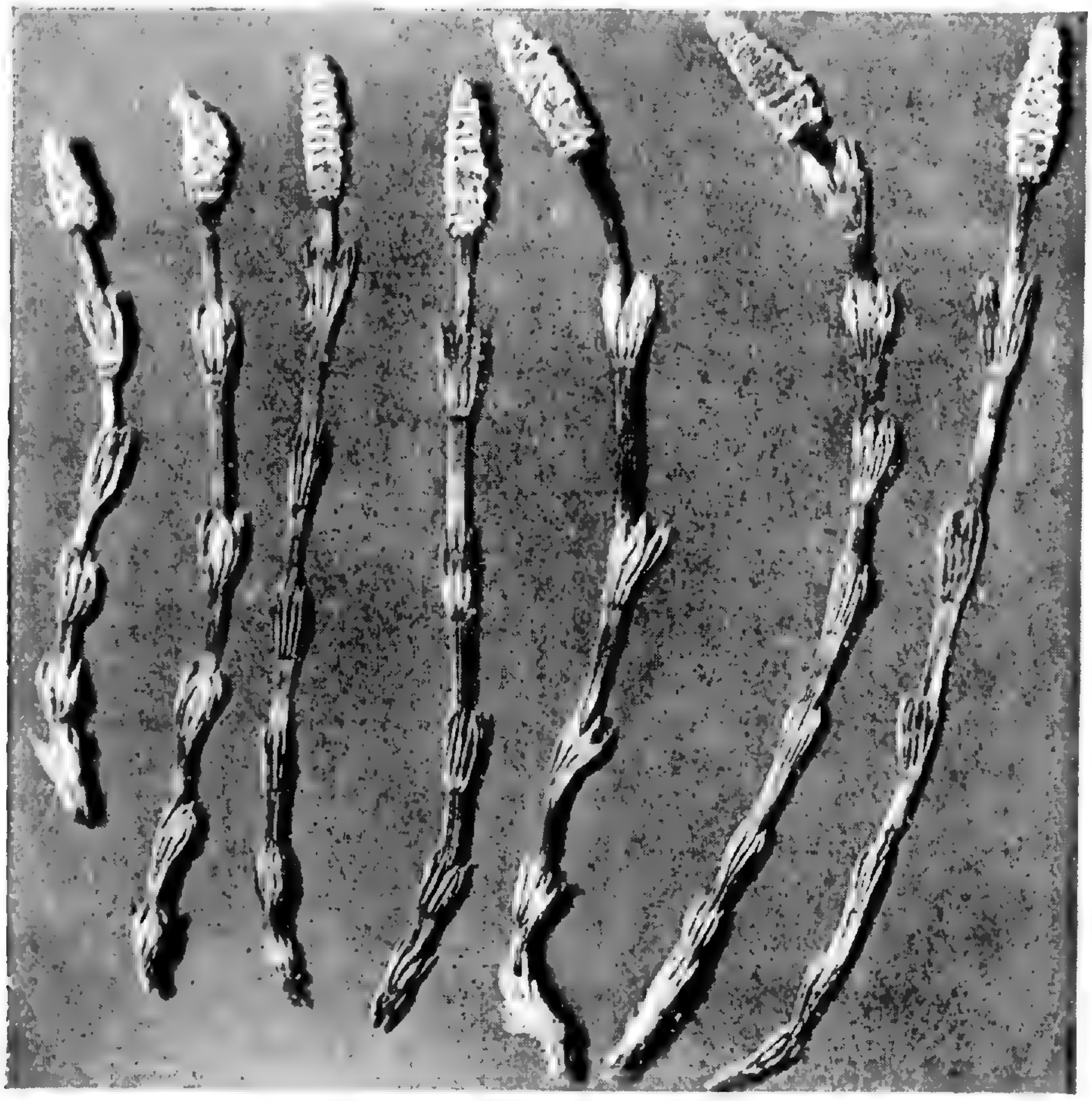
† Denotes that owing to two or more leaf-sheaths coming close together the distance from one to the next or between successive internodes cannot be readily determined.

‡ Denotes that the specimen is incomplete at one or both of the extremities.

II C. *Comparison between the position and function of the short internode in* Calamites *and recent* Equiseta, *and the rate of increase or decrease of internodes, etc., in both groups.*

Summarizing the foregoing facts for comparison, it is to be noticed that in *fertile* stems of *Equisetum maximum* and *E. arvense* there is a gradual *increase* in the length of internode (and of leaf-sheath) up to the last but one, the last internode before a cone being shortened *. The smallest internode is at the base, or just below the cone.

The converse is found in *barren* stems of *E. maximum*, the internodes *decreasing*. In *E. pratense* the two modes alternate, a short node separating the two kinds of periods. The same is found in other species of *Equisetum*.



Fertile stems of *Equisetum arvense*, Linn.
(See Tables III. & IV. p. 283.)

Thus in Equisetales (*cf.* short internode in *C. Schützei*, and at the base of the stem in *C. Suckovii*) shortened internodes occur at the base or between fertile and barren periods, as noticed in recent *Equiseta* and *Calamites*. Thus the largest internodes appear, in a compound species (by which we mean combining fertile and barren periods), to aggregate towards the centre normally. A short internode divides them, preceding a branch-bearing period.

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* In some cases the terminal internode just before the cone is sometimes not shortened but the longest internode in the series in fertile stems of *Equisetum arvense*, Linn. This is owing to nature of soil or shade.

This feature is noticed in the subgenus *Calamitina* and in a modified form, as remarked, in the other subgenera *Stylocalamites* and *Eucalamites*. In combination with the many other features possessed by Calamarieæ and Equisetaceæ in common, this additional character is another argument in favour of their union under the group Equisetales.

Apparently the uniformity in the gradual increase in length of internode bears some relation to height. In cases where there are more than the usual number in *Equiseta* the supernumerary ones, though high up in the stem, are sometimes shorter than others below, due to necessity for increased strength or dearth of water-supply.

In some species, e. g. *E. sylvaticum*, the abnormal decrease is due to the overlapping of two or more leaf-sheaths, and the internodes are reduced in length, as before a cone or branch-bearing period.

In some cases the internodes between branch-bearing nodes after normal decrease suddenly elongate. This is doubtless due to habitat, *E. sylvaticum* favouring a shady locality. They decrease after a branch-bearing node, as in *E. arvense*, *E. maximum*, *E. pratense*. In these the last internode before a cone is shortened. It is, then, a fair inference that a foreshortening in length of an internode immediately precedes a new cycle of organs, or a grand period, as Strasburger calls it. Occurring at the base of the branchless period, or just before the branched whorls, or a cone, as it does in recent *Equiseta*, it presents a strong analogy to the short internode in *Calamites Schützei*, Stur, in position and function, and there is good reason to regard them as homologous.

In the extinct species the branched and branchless whorls occur in combination, and not separately as in *Equisetum*. Owing to their fragmentary state of preservation, a long sequence of internodes has not been examined, and we do not know as yet with what stems to correlate the cones, etc. The instances adduced on either side, *i. e.* fossil and recent forms, serve to indicate the homology of the structure. Whether there has been reduction or no, we cannot definitely say, but it seems extremely probable, since *Equisetum* is certainly a reduced from. The short internode with the function and position indicated may thus be regarded as typical of Equisetales in general. The details of its variation may be worked out later. The significance it affords is that it marks the introduction of an additional organ or series of organs and the commencement or conclusion of a period.

Recapitulating, it is found that in living plants of *Equisetum* the shortest internode or leaf-sheath separates the root-bearing subterranean portion from the aerial branchless stem, and after a gradual increase in length a second short internode occurs in fertile stems, as in *E. maximum*, *E. arvense*, *E. pratense*, just before the strobilus or cone. In barren stems this takes place at the internode preceding a branch-bearing period, and thence upward there is a decrease in length. In *E. sylvaticum*, a type in which fertile and barren periods are combined, a decrease first occurs in the branched period, then an increase, and finally just before a cone there is a further decrease. Where the stem is barren the internodes decrease gradually throughout the branched period.

In *E. limosum* and *E. litorale* some variation occurs (*vide* Table V, which should be compared with those relating to the fossil forms).

When compared with *Calamites Schützei*, Stur *, there is seen to be a close correspondence in the actual length of internodes, and the relative position and uniform occurrence of a short internode, dividing different growth-periods.

In *Eucalamites* and *Stylocalamites* the same analogy may be traced, in a modified form. In the former branches regularly occur on every node, and these are short and closely placed. In *Stylocalamites*, in subterranean stems the increase in length from the point of contact with aerial stems is strictly homologous with that found in the dominant type *Equisetum arvense*, L. Where in *Eucalamites* the branches are few and lateral, the internodes are unequal and longer. The unequal or equal character of internodes may be put down to the position of branch-bearing nodes and the number of branches.

Stylocalamites affords a sort of intermediate subgenus between *Calamitina* and *Eucalamites*. *Asterocalamites*, a subgenus which is founded on entirely different characters, is not here considered.

III. *General conclusions.*

As a result of the comparison made between *Calamites* and *Equisetum* it appears that some general principles underlie the characters noticed.

The close correspondence here established between the position and function of the short (or shortened) internode and the mode of increase or decrease of internodes in both extinct Calamariceæ and recent Equisetaceæ constitutes still further evidence as to their close relationship, and it may be inferred that the common ancestor of the primitive Equisetales resembled them in this respect.

There is, in fact, a strong resemblance between the two groups in the position of the short internode, and a very marked similarity in the uniform rate of increase or decrease in the length of the internodes in both groups also, most apparent in the subgenus *Calamitina*, but probably in a modified

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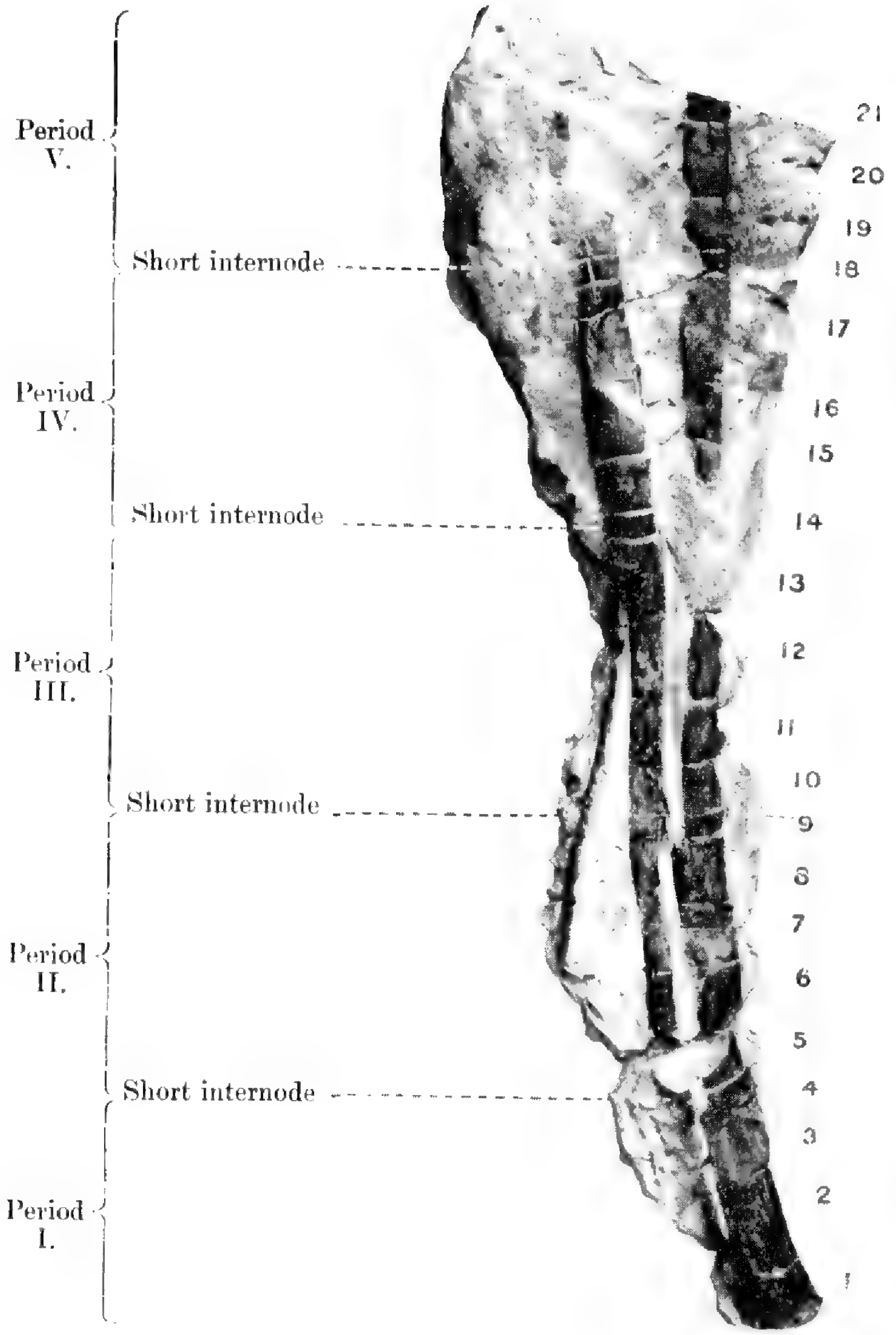
* Stur's original figure is represented upside down.


Period V.
Short internode
Period IV.
Short internode
Period III.
Short internode
Period II.
Short internode
Period I.
21
20
19
18
17
16
15
14
13
12
11
10
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8
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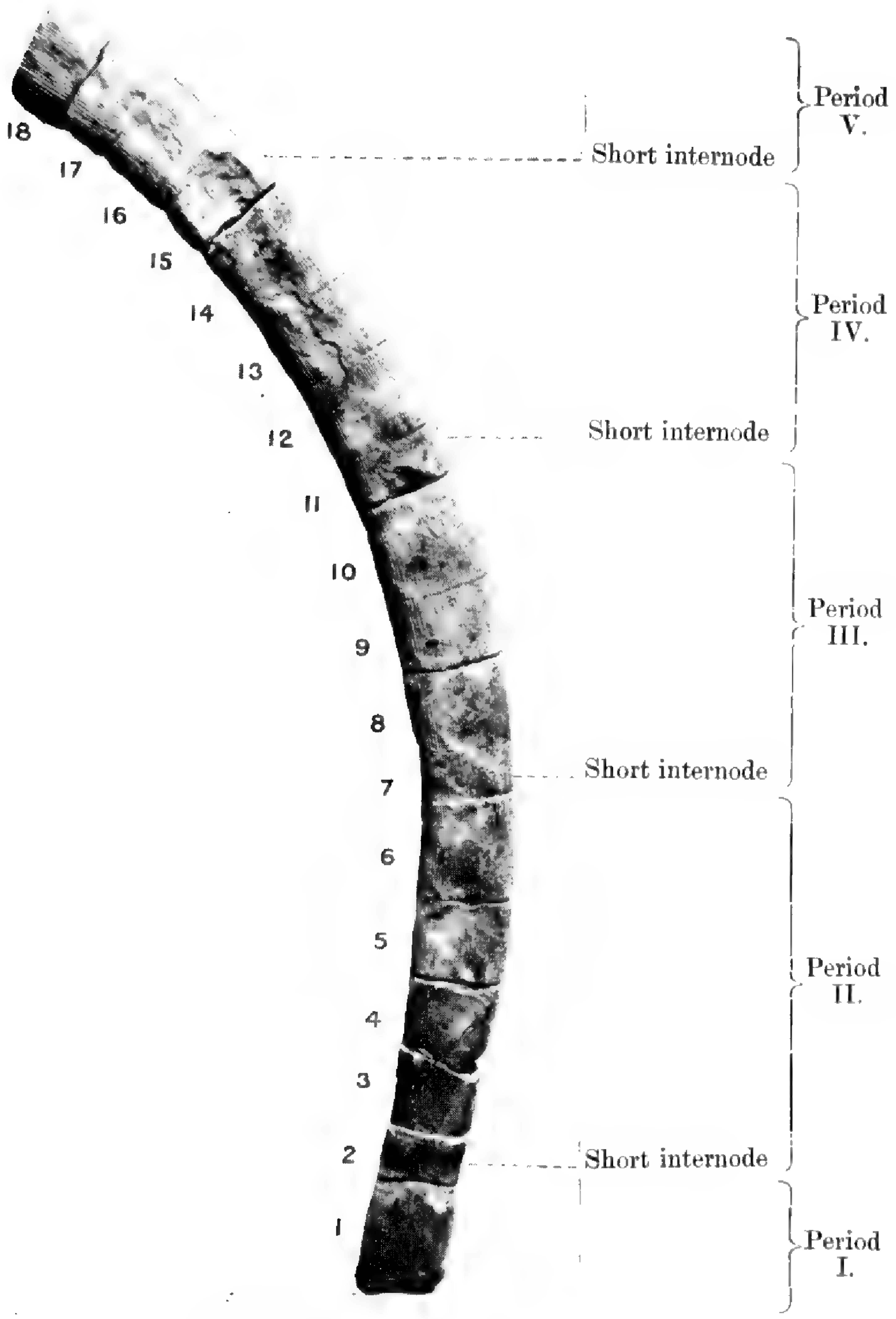
1

A. Newton, phot. Grout, sc.

CALAMITES (CALAMITINA) SCHÜTZEI, *STUR.*



18
17
16
15
14
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12
11
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9
8
7
6
5
4
3
2
1
Period V.
Short internode
Period IV.
Short internode
Period III.
Short internode
Period II.
Short internode
Period I.

A. Newton, phot. Grout, sc.

CALAMITES (CALAMITINA) SCHÜTZEI, *STUR.*

form in *Eucalamites* and *Stylocalamites,* and in subterranean stems of *S. Suckovii* there is a strict homology.

The function in both groups was probably the same. The following premises, as to the position and function of the short internode, may be stated :—

a. *Position.* The short internode precedes a new period, *i. e.* is situated
(1) at the base of the stem ;
(2) between branchless and branch-bearing series;
(3) before the strobilus or cone ;
(4) in Calamarieæ before a combination of (1) and (2).

b. *Function.* It bears some relation to height, which is explained by the physiological laws of growth as they apply to elongation. Its function appears to be to add strength to the stem by the occurrence of two consecutive strengthening nodes (with diaphragms) serving the purpose of a double support within a short distance.

EXPLANATION OF THE PLATES.

PLATE **18.**

Calamites **(*Calamitina*) *Schützei*, Stur, Middle Coal-measures, Main Coal, Stanton-under-Barton, Leicestershire. Exhibiting graphically the hollow pith-cavity of *Calamites* and the periodic occurrence of a short internode. $\frac{1}{6}$ nat. size.**

PLATE **19.**

(*Calamites*) (*Calamitina*) *Schützei*, Stur, Coal-measures, Brighouse, Yorkshire. Exhibiting the regular occurrence of a short internode, as in Plate 18. Circ. $\frac{1}{6}$ nat. size.

On Elm-seedlings showing Mendelian Results.

By AUGUSTINE HENRY, M.A., F.L.S.

(PLATES **20-24** and 2 Text-figures.)

[Read 7th April, 1910.]

THERE are two species * of Elms in the British Isles—*Ulmus montana*, With., often found in woods throughout England, Scotland, and Ireland; and *Ulmus glabra*, Miller, rarely if ever found in woods, and limited as a common tree to hedgerows and parks in the east of England, and also somewhat prevalent in Cornwall and the south of Ireland. I regard the latter species as the elm which flourished in prehistoric times in the forests of the alluvial lands with better soil, now given up to agriculture. In France †, Germany, Belgium, and Denmark this tree is rare in woods, becoming a component of the forests further south, as in the alluvial lands of the Danube. The elm of the Mediterranean region is a distinct race, much more pubescent than true *U. glabra*.

The main differences between the two species of elms may be tabulated as follows:—

U. montana.	*U. glabra.*
Branchlets stout, pubescent, remaining smooth in the second year.	Branchlets slender, nearly glabrous, becoming striated in the second year.
Leaves large, thick in texture, very pubescent especially on the upper surface, with short stalks.	Leaves small, very thin in texture, glabrous on the upper surface, with long stalks.
Seed in the centre of the samara.	Seed near the upper edge of the samara.
The tree rarely suckers.	The tree suckers freely.

Both these species are wide-branching trees, and are known by the same name—wych-elm—in the east of England.

In addition to these two species, there are many so-called varieties of elms, some of which are considered to be varieties of *U. glabra*, others being supposed to be distinct species.

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* The correct nomenclature of the Elms is still uncertain; and the names used here are well-known ones, not necessarily those which I shall ultimately adopt.

† I am not concerned in this paper with the third European species, *U. pedunculata*, Foug., which belongs to another section, and is almost indistinguishable from *U. americana*, Linn., of North America.

The most remarkable of these is the "English elm," the *U. campestris* of English botanists and foresters. It is confined to hedgerows in the south of England, has a distinct habit, possesses a reddish wood unknown in other elms, and rarely produces fertile seed *. It has pubescent branchlets and leaves, the latter being different in shape from those of *U. glabra*, but with long stalks. The tree is unknown on the Continent. In branchlets and leaves it strongly resembles the southern elm, that on which the vine is trained in northern Italy. On this account it is supposed to have been introduced at an early period into Britain either by the Romans or by the monks, when they were importing the vine into this country. I am at present investigating its possible relation to the southern or Italian elm ; but am inclined, nevertheless, to the opinion that it is, like the other varieties of elm in England, one of the descendants of the first cross between the two species, possibly due to a second hybridisation of some of these descendants with *U. montana*.

The Huntingdon elm (*Ulmus vegeta*) is commonly looked upon as a hybrid, and I consider it to be the first cross between *U. glabra* and *U. montana*, though this is not certain, but may be proved by experiments that we are making at the present time. The branchlets are stouter than in *U. glabra* and often do not become striated. The leaves resemble those of *U. glabra* in the absence of pubescence on the upper surface and in their long stalks, but are as thick as those of *U. montana*. The samaræ are intermediate. This tree suckers freely, produces an abundance of fertile seed, and has a peculiar habit, the branches being very ascending. It is, like most first crosses, extraordinarily vigorous, growing faster than any other elm. This is well seen in the Victoria Park, Bath, where nearly forty kinds of elms were planted about 1820. The Huntingdon elm there is twice as large as any of the other kinds. Loudon gives as an instance of its extraordinary vigour, that one planted only ten years in the Chiswick Garden had attained 35 feet in height. The Huntingdon elm originated as a seedling in a nursery at Huntingdon about 1746–1756. I may here draw attention to the fact that the Huntingdon elm, like most first crosses in trees, leans much more to one of the parents than to the other. Most of the characters of *U. glabra* are dominant. The comparatively large size of the leaf is due to vigour merely.

A great many other kinds of elms are known, not only in cultivation, but arising spontaneously in hedgerows ; it would be easy around Cambridge to find in the hedgerows five or six very distinct varieties. Most of these elms have distinct habits and vary extremely in foliage. I may here point out, however, that the occurrence of trees with suberose branchlets appears to be a sporadic phenomenon * in each variety, and may be looked upon as a peculiarity of an individual tree, not as a characteristic of a variety. Absolutely pure *U. glabra* is frequently characterised by branchlets with excessively corky wings ; and at Kew, where there are three young trees of the English elm, all suckers from an older tree, one of these is extremely suberose. Any characterisation of a variety of elm by suberose branchlets alone is certain to be erroneous.

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* It produces samaræ as freely as the other elms, but its seed is nearly always imperfect. It is invariably reproduced in the hedgerows by suckers.

I need not now give the distinguishing characters of the many varieties of elms, but will pass on to the experimental sowings which I made in June 1909. In the spring of 1909 every kind of elm produced fruit in exceptional abundance—due to the good weather prevalent in the autumn of 1908, and to the fact that in the months of March, April, and May, 1909, the amount of sunshine in the south of England was greater than had ever before been recorded by the meteorologists. I sowed † ninety different lots of seed.

The first fact established is, that there are only two kinds of elms which give, when sown, *uniform* seedlings. These are the two pure species, *U. montana* and *U. glabra*. A box of *U. montana* seedlings are all uniform in size and other characters. The same applies to a box of *U. glabra* seedlings. Every other kind of elm when sown produced mixed seedlings, of different sizes, different arrangement of leaves, &c.

The seedling of *U. glabra* has a stiff, unbranched, erect stem, with *all* the leaves small in size and in opposite pairs.

The seedling of *U. montana* has an unbranched stem drooping to one side, with large leaves, only the first two pairs of which are opposite, all the other leaves above being alternate. For the sake of convenience, I shall speak of the seedlings of this kind as "alternate-leaved" seedlings ‡.

The seedlings, then, of the two species are very easy to discriminate in the first year ; and this fact has much facilitated our counts of the various lots of seedlings and the deductions that follow from these counts.

Several sowings were made of the Huntingdon elm. The seed was taken from one of the trees in Brooklands Avenue, Cambridge. This road is planted on both sides with a large number of Huntingdon elms, all of the same age and quite unmixed with other elms. There was no possibility here of contamination with the pollen of other kinds. All the seed then was "selfed." The Huntingdon elm was the source both of the pollen and of the ovules *.

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* This is the case with *Liquidambar styraciflua*. Raised from the same seed, some trees at Kew have very corky twigs, others are perfectly smooth.

† Elm seed should be sown as soon as ripe in June ; and the best seedlings are obtained by sowing in open beds in good garden soil. Most of my plants were raised in boxes and were too crowded, and had not depth enough of soil to develop well.

‡ When injured by frost &c., elm-seedlings occasionally branch in the first year ; and in such cases, in *U. glabra*, alternate leaves are always produced on the branches. This is in anticipation of the characters of the second year, when the leaves become alternate and remain so ever afterwards. Such branched seedlings were few in number, and in no case were included in our counts of the various lots of seedlings.

The best crop of Huntingdon elm-seedlings was raised in garden soil by Mr. W. O. Backhouse †, one of my students. These seedlings, 971 in all, were counted *as regards one character*, and showed :—

732 seedlings with opposite leaves.
239 „ „ alternate leaves.
971

The Mendelian ratio 3 : 1 is here closely followed, as the theoretica numbers are 732 : 244 (see Table 1, p. 298).

A further examination of these seedlings showed that there were four kinds plainly visible in the bed, namely :—

		Ratio.
Small,	opposite-leaved	9 (?)
Large,	„ „	3 (?)
Small,	alternate-leaved	3 (?)
Large,	„ „	1 (?)

I have added here the theoretical ratio 9 : 3 : 3 : 1 ; but of this we are not certain, as it was impossible to count the seedlings, as regards two characters, without injuring them ; and we wanted to preserve the whole crop. Mr. Backhouse considered that the 9 : 3 : 3 : 1 ratio probably existed in this lot of 971 seedlings.

The production of these four forms is easily explained by the diagram (Table 2, p. 299).

Another examination of these seedlings shows that some have leaves with short petioles, whilst others have leaves with long petioles. This makes 8 different kinds of seedlings. Taking into account the other points of difference on the two species, there are possibly 64 different kinds amongst the seedlings of the Huntingdon elm. Some of the characters will interact on each other; and as a result, there is a possibility of nearly all the known varieties of elms appearing in the F_2 generation, *i. e.* amongst the Huntingdon elm-seedlings. At this moment, at Cambridge, there are numerous seedlings of the Huntingdon elm in the fields and hedgerows, some of which will survive, and constitute, when they grow up, peculiar elms for botanists to quarrel about, and from which nurserymen could make selections.

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* Knuth, 'Flower Pollination' (Engl. transl.) iii. 373 (1909) says :—"The flowers in *Ulmus* are anemophilous and protogynous. The stigmas are mature when the flower opens and project beyond the anthers, which are still immature with short filaments. The latter elongate later on, so that the stigmas are hidden among the stamens ; the anthers then dehisce ; and the stigmas, which are *still receptive*, may be fertilized by automatic *self-pollination*, if they have not been already dusted with foreign pollen. The flowers are in crowded clusters and do not mature simultaneously." It is, I think, probable that in most cases each elm flower is fertilized by pollen from another flower of the same tree.

† I may here express my indebtedness to Mr. Backhouse for help and suggestions in connexion with the experiments on the elms, and the explanation thereof.

Sowings of a considerable number of peculiar elms, *e. g.*, of a remarkable elm at Cambridge which has small leaves and minute fruit, of the Jersey elm, of trees called Cornish elm at Kew, &c., &c., all show mixed seedlings, of which I may quote a few examples.

A tree at Colesbourne, supposed to be *U. glabra*, but which differs from the pure species in having larger leaves, differently shaped and much thicker in texture, when sown, gave 245 opposite-leaved seedlings and 95 alternate-leaved seedlings. This is quite near the 3 : 1 ratio, and there is no doubt that this tree is one of the descendants of *U. glabra* × *U. montana* ; but as this type of tree is common, we can imagine it to be a descendant from a very early cross, made perhaps hundreds of years ago.

The seed of the Jersey elm from a tree in the Southampton Cemetery gave only a small number of seedlings, 17 with opposite leaves and 19 with alternate leaves. With small numbers the ratio 3 : 1 is not observed.

A tree in Huntingdonshire, considered by Rev. Aug. Ley to be a species indigenous to that county, gave 310 opposite-leaved and 84 alternate-leaved seedlings. In crowded boxes, the ratio 3 : 1 is not accurately observed.

As regards the fertility of the seed, the two pure species and the Huntingdon elm are excessively fertile. The other varieties, which I consider to be descendants, are very variable in fertility, as witnessed by the appearance of the boxes, some crowded with seedlings, others with only one seedling or with none. Of the "English elm," 19 different boxes, of seed gathered at Cambridge, at Kew, in the Isle of Wight, in Gloucestershire, near Exeter, &c., showed not a single seedling. A few seed gathered at Parkhurst, Isle of Wight, which looked better than any I saw elsewhere, produced one seedling. A tree at Bayfordbury produced two seedlings, which, however, I look upon as doubtful, as they may have come in from seed from an adjoining box. A tree at Cambridge, which is absolutely like the English elm in all respects, except that it is rather wide-spreading in habit, gave a single seedling like the Parkhurst seedling.

An examination this year shows that the flowers of some of the "varieties" tend to be malformed ; and I have no doubt that in the act of combination of the various characters that make up certain of the F_2 generation the reproductive organs are badly formed. This is possibly what has occurred in the "English elm," which no doubt would have soon disappeared if it had not been a free suckerer, and had not also been selected to a considerable extent by human agency, as owing to its good form and its excellent timber it is superior to either *U. glabra* or *U. montana* as a hedge-tree.

All the different seedlings reared, about 5300 in number, each lot of which has a well-known tree for its parent, have been planted out this year in the experimental forestry plot on the University Farm at Cambridge; and if they grow up, I have no doubt that we shall see all the possible existing varieties of elms amongst them.

These experiments seem to show that what are called *varieties* are often simply Mendelian combinations of two existing species. I may here point out, that where there is only one species of tree existing in a country or territory, such varieties are unknown. For example, the beech, a single species, throughout Europe, has no varieties of the kind so common in elms. All the varieties of beech are of another kind, what I may call "*sports*," where we may suppose the variation to be due to some malformation or misdirection of growth in the individual plant. These are as follows:—Variations in colour, as the purple, copper, golden, and variously variegated beeches; variations in form of the leaf, all more or less bizarre, as var. *heterophylla* (the fern-leaved beech), in which the leaves become mere shreds; var. *quercoides*, with deeply pinnate leaves; var. *cristata*, leaves small and crowded in tufts; pendulous, fastigiate, and twisted-stem beeches, in which there is malformation in the habit of the tree. The beech shows in no way the kind of variation that has arisen in elms, as it has not had another species with which to make combinations.

In the common ash (only one species occurring in northern and central Europe) the varieties known are all mere sports, similar to those mentioned for the beech.

In the case of the oak, birch, and lime, in which there are two species existing in the same region, the variations are like those in the elm. In southern Europe, where the number of species of oak increases, the number of varieties increases likewise, to an alarming extent, as no less than 35 varieties are described of *Quercus Ilex*, which is so often associated with *Q. Suber*.

These investigations have also served to guide me to a correct appreciation of the poplars, which have been so long a puzzle to systematists. I may here advert to the Black Poplars. We have in cultivation in this country *Populus nigra*, the European Black Poplar; *Populus serotina*, Hartwig; a hybrid, the Black Italian Poplar, always a male tree; and a number of female trees, which, like the last, are generally supposed to be forms of the American species, *P. deltoidea* *. There are also the poplars put on the market by French nurserymen, as *P. Eugenei*, *P. regenerata*, &c.

The American Black Poplar (*P. deltoidea*) was introduced into France about 1700, and arrived in England some years later.

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* I exclude from consideration here *P. angulata*, another American species, occasionally met with in England, very distinct and easily recognizable.

The differences between the two true species are as follows :—

P. nigra (Europe). Leaf: non-ciliate in margin ; without glands at the base ; cuneate at the base ; long-acuminate at the apex.

P. deltoidea (N. America). Leaf : densely ciliate in margin ; with two glands at the base on the upper surface ; truncate at the base ; cuspidate at the apex.

Soon after the American species was introduced in the eighteenth century into France, a first cross accidentally arose, which became known in France as *P. nigra helvetica* or "Peuplier suisse," and when imported into England was called the Black Italian Poplar. Arising as a single tree (which has been always reproduced by cuttings) it happened to be a male. Selected at once, on account of its astounding vigour, characteristic of first crosses in trees, it is amply distinct from either of the parents, not only by its rapid growth, but by its habit,—slender ascending branches and straight cylindrical stem. Scarcely any other tree produces such a volume of timber per year ; and its economic importance in France and Belgium, and even in England, is extreme.

It is characterized as follows :—

P. nigra × *deltoidea* (*P. serotina*), First cross. Leaf with a few cilia irregularly disposed on the margin ; glands at the base variable, 0, 1, or 2 on each leaf ; in shape like *P. deltoidea*, but appreciably different.

Some time after the first cross was obtained, further crossing occurred from time to time, and we now have at least two forms of a female tree, which differs not only from *P. serotina*, but also from *P. deltoidea* ; and these are comparatively valueless, as they grow slowly, and differ in habit from the Black Italian Poplar. I need not pursue the history of these poplars further ; but *P. Eugenei*, *P. regenerata*, &c. are all later products.

So far as I can judge, but my investigations are not yet finished, the Cricket-bat Willow, which is known only as a female tree, and which originated in Norfolk about 1700, is the first cross between *Salix alba* and *S. fragilis*,—but, like most first crosses, much more strongly resembles one parent than the other. It is, in fact, so close to *S. alba* in its botanical characters that it is universally considered to be a variety of that, viz. *S. alba cærulea*. If it were a variety simply, *e.g.* a geographical race, how explain its occurrence in one sex only ? The economic importance of this tree, which grows twice as fast as *S. alba*, is very considerable.

The history of the Lucombe Oak is very enlightening, as Loudon obtained accurate particulars of it, and we are in no doubt as to the facts. The Lucombe Oak was raised at Exeter in 1763 from an acorn of a Turkey Oak (*Q. Cerris*) which had been pollinated by a Cork Oak (*Q. Suber*) growing near it. This seedling turned out to be subevergreen, and made astonishingly rapid growth; and on this account Lucombe propagated a large number of trees by grafts from it. In its characters, this first cross resembles *Q. Cerris* in the form of the leaves and in the persistent stipules round the buds; but has the mucronate points to the serrations which are characteristic of *Q. Suber*. One of its parents is deciduous, the other is evergreen; it is subevergreen, the leaves falling in January and February.

In 1792 the acorns of the Lucombe Oak were sown; and a crowd of forms appeared in the seedlings, some of which were preserved, but none equalled in vigour the parent tree. Some of the seedlings are very close to *Q. Suber* in bark and are nearly evergreen, keeping the leaves on till May.

Here, again, we notice the extreme vigour of the first cross; and the disintegration, so to speak, of the first cross into numerous forms, so soon as its seed is sown. The facts about the Lucombe Oak are strictly parallel to what is going on in the elms.

The practical corollary to all these observations seems to me evident. We have instances in the Black Italian Poplar, in the Huntingdon Elm, in the Lucombe Oak, probably in the Cricket-bat Willow, of vigorous first crosses that were produced accidentally, and which are timber trees of considerable value. Why not, then, proceed to make artificially first crosses in other trees, with still more valuable timber? In the Ash and Walnut* the quality of the wood, owing to its structure, will be improved the faster the tree grows; and both these trees produce already extremely valuable timber. First crosses, of course, can only be reproduced by cuttings or by grafting; and considerable difficulty may be anticipated in adapting on a large scale these modes of reproduction to forest trees. But our resources are not exhausted, as there is no telling but that amongst the crowd of different combinations that appear in the F_2 generation there may exist one which will display great vigour and yet breed true. This is the next step to explore.

In countries like our own, the only hope of salvation for forestry is in growing timber rapidly: and we have been helped in that by the introduction of fast-growing trees like the Larch, the Corsican Pine, and the Douglas Fir. But it is essential to grow the more valuable classes of non-coniferous timber; and I see no reason why the attempt should not now be made to essay experiments on the lines laid down in this paper. We are ourselves making some experiments in cross-fertilization this year; but more workers are required in this field. Hitherto nothing whatever has been done to improve the breeds of forest trees; and foresters have never even thought of the possibilities in this direction, though gardeners and farmers have shown the way for centuries.

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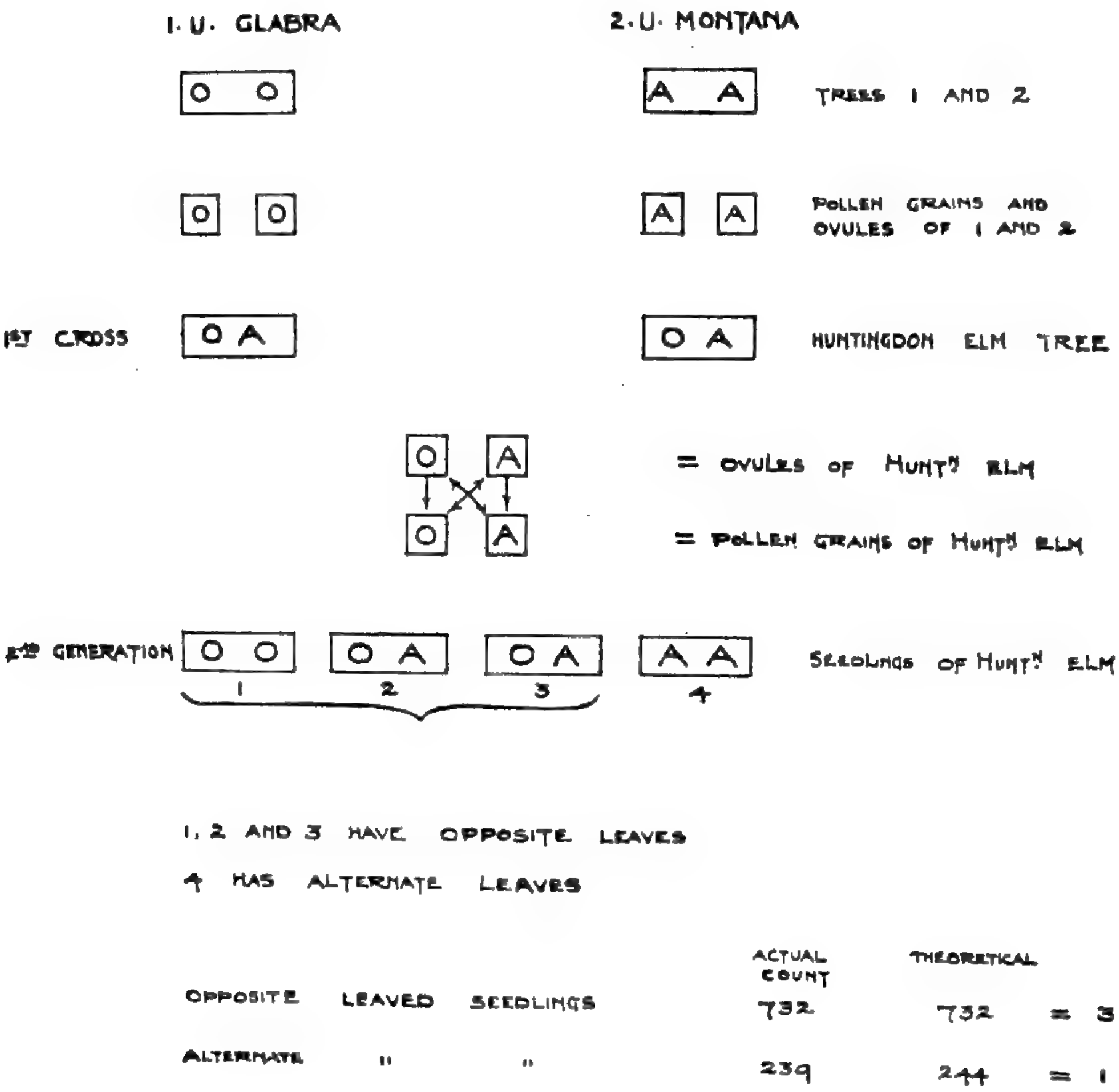
* De Vries, in 'Plant-Breeding,' 174, fig. 37 (1907), describes a remarkable first-cross walnut which he saw in California. The particulars which he gives about its fastness of growth are so astounding as to seem incredible. I have no doubt, however, of the correctness of his observation.

Table 1*.


1. U. GLABRA
2. U. MONTANA
O O
A A
TREES 1 AND 2
O O
A A
POLLEN GRAINS AND OVULES OF 1 AND 2
1ST CROSS
O A
O A
HUNTINGDON ELM TREE
O A
O A
= OVULES OF HUNTN ELM
= POLLEN GRAINS OF HUNTN ELM
2ND GENERATION
O O
O A
O A
A A
1
2
3
4
SEEDLINGS OF HUNTN ELM
1, 2 AND 3 HAVE OPPOSITE LEAVES
4 HAS ALTERNATE LEAVES
ACTUAL COUNT
THEORETICAL
OPPOSITE LEAVED SEEDLINGS
732
732
= 3
ALTERNATE " "
239
244
= 1

The Mendelian ratio 3 : 1 is here closely followed, as the theoretical numbers are 732 : 244.

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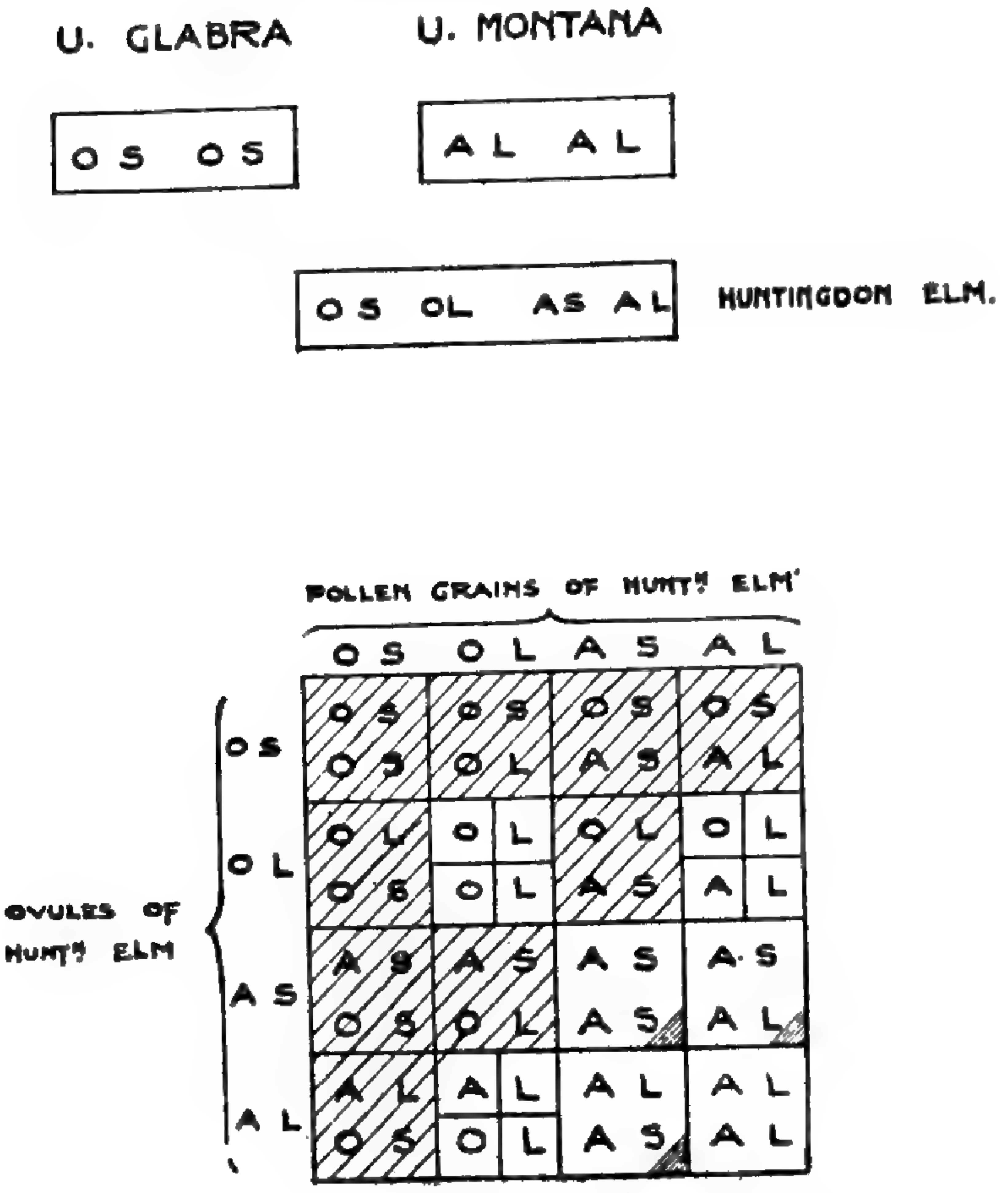
* In the figures, A = Alternate-leaved seedling.
O = Opposite- " "
S = Small- " "
L = Large- " "

TABLE 2*.


U. GLABRA
U. MONTANA
OS OS
AL AL
OS OL AS AL
HUNTINGDON ELM.
POLLEN GRAINS OF HUNT^N ELM'
OS OL AS AL
OVULES OF HUNT^N ELM
OS
OL
AS
AL

IN THE 16 SQUARES ARE 16 SEEDLINGS OF THE HUNTINGDON ELM
4 VISIBLY DIFFERENT KINDS

OS OS	PURE, AND 8 IMPURE	= 9	▨
OL OL	PURE, AND 2 IMPURE	= 3	⊞
AS AS	PURE, AND 2 IMPURE	= 3	◪
AL AL	PURE.	= 1	□

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* Every *U. glabra* tree is OS OS.
Every *U. montana* tree is AL AL.
Each Huntingdon elm tree must contain all these characters, and is OS OL AS AL.
Its ovules must be of 4 kinds, and of 4 kinds only:—OS, OL, AS, AL.
Its pollen-grains must also be of these 4 kinds.

There are 16 different kinds of seedlings possible.

Of these, as O is dominant to A,
and S ,, ,, L,

there are 9 seedlings which will look OS. Those containing OS.
3 ,, ,, ,, OL. Those containing no S, and containing OL.
3 ,, ,, ,, AS. Those containing no O, and containing AS.
1 ,, ,, ,, *AL*. This contains neither O nor S.

Only one of each of these 16 kinds will breed true, namely, the four,

OS OL AS AL.
OS OL AS AL.

EXPLANATION OF THE PLATES.

Plate 20.

Huntingdon Elm; old tree in the Fellows' Garden, Trinity College, Cambridge.

Plate 21.

Branchlets of *Ulmus glabra*, of *Ulmus montana*, and of the Huntingdon Elm, illustrating the foliage of adult trees.

Plate 22.

Elm-seedlings, *Ulmus montana* on the left, *Ulmus glabra* on the right.

Raised from seed sown, as soon as ripe, on 1st June, 1909. Photographed on 7th October, 1909.

Plate 23.

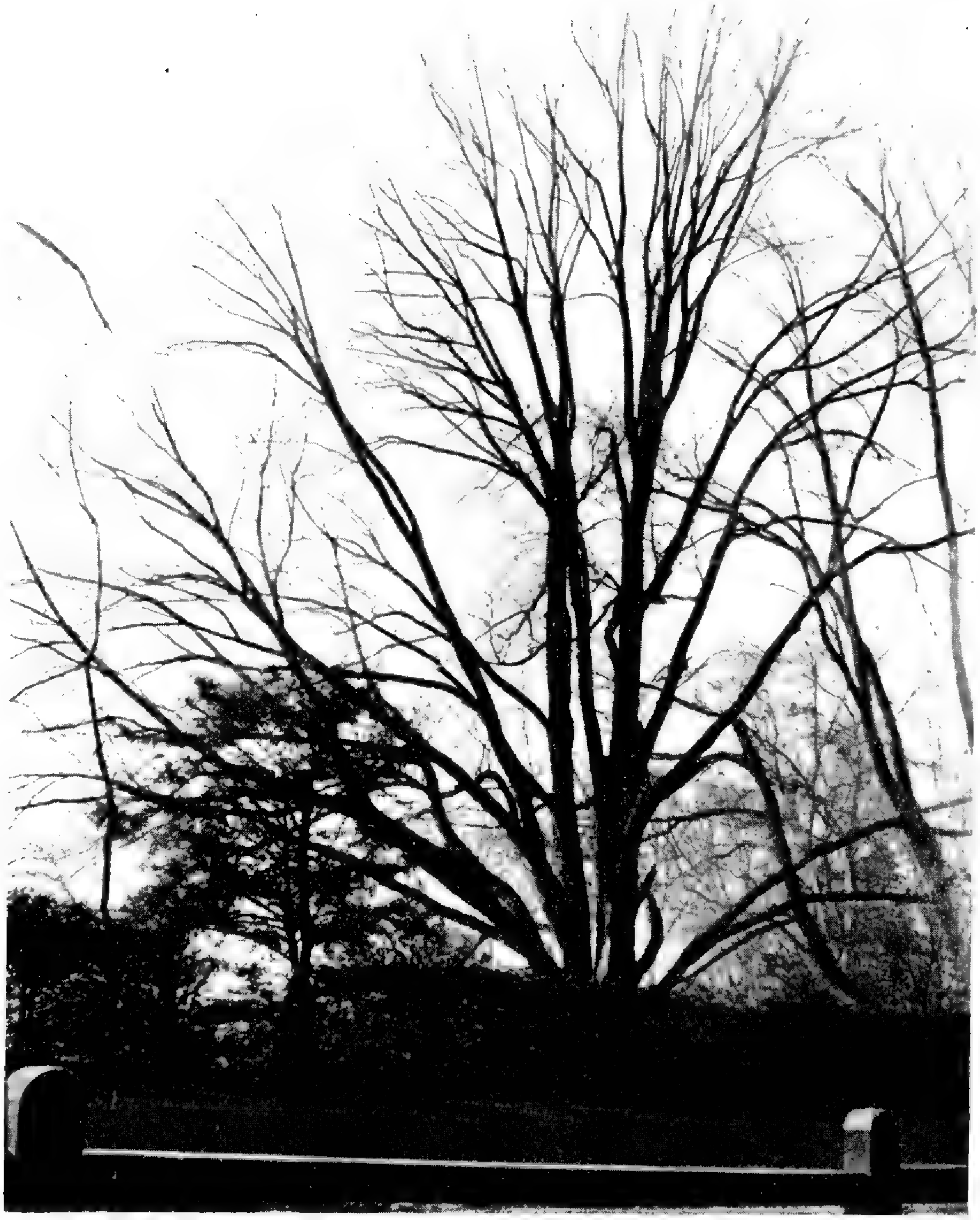
Seedlings of the Huntingdon Elm, taken from a bed of 971 seedlings, which was plainly divisible into the four kinds illustrated, viz. (from left to right):—

(*a*) Seedlings with opposite large leaves.
(*b*) „ „ „ small „
(*c*) „ „ alternate large „
(*d*) „ „ „ small „

On comparing these with Pl. 22. it will be seen that, so far as regards the two characters concerned (position and size of the leaves), *b* is similar to the seedling of *U. glabra*, *c* is like that of *U. montana*, and *a* and *d* are new kinds.

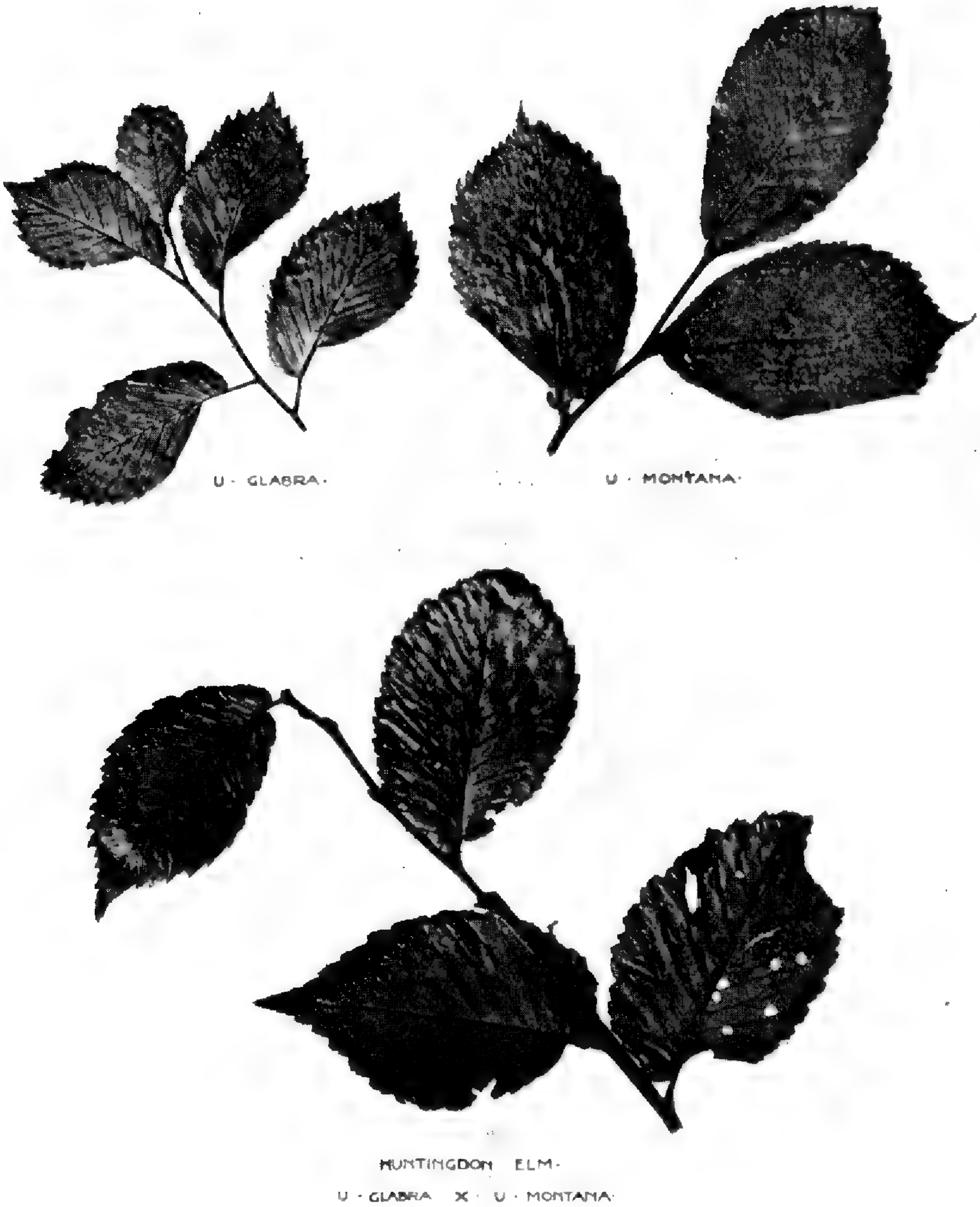
Plate 24.

The Lucombe Oak, its parents, and a few of the peculiar 'varieties' which were raised from its acorns. The branchlets represented were taken in all cases from adult trees.



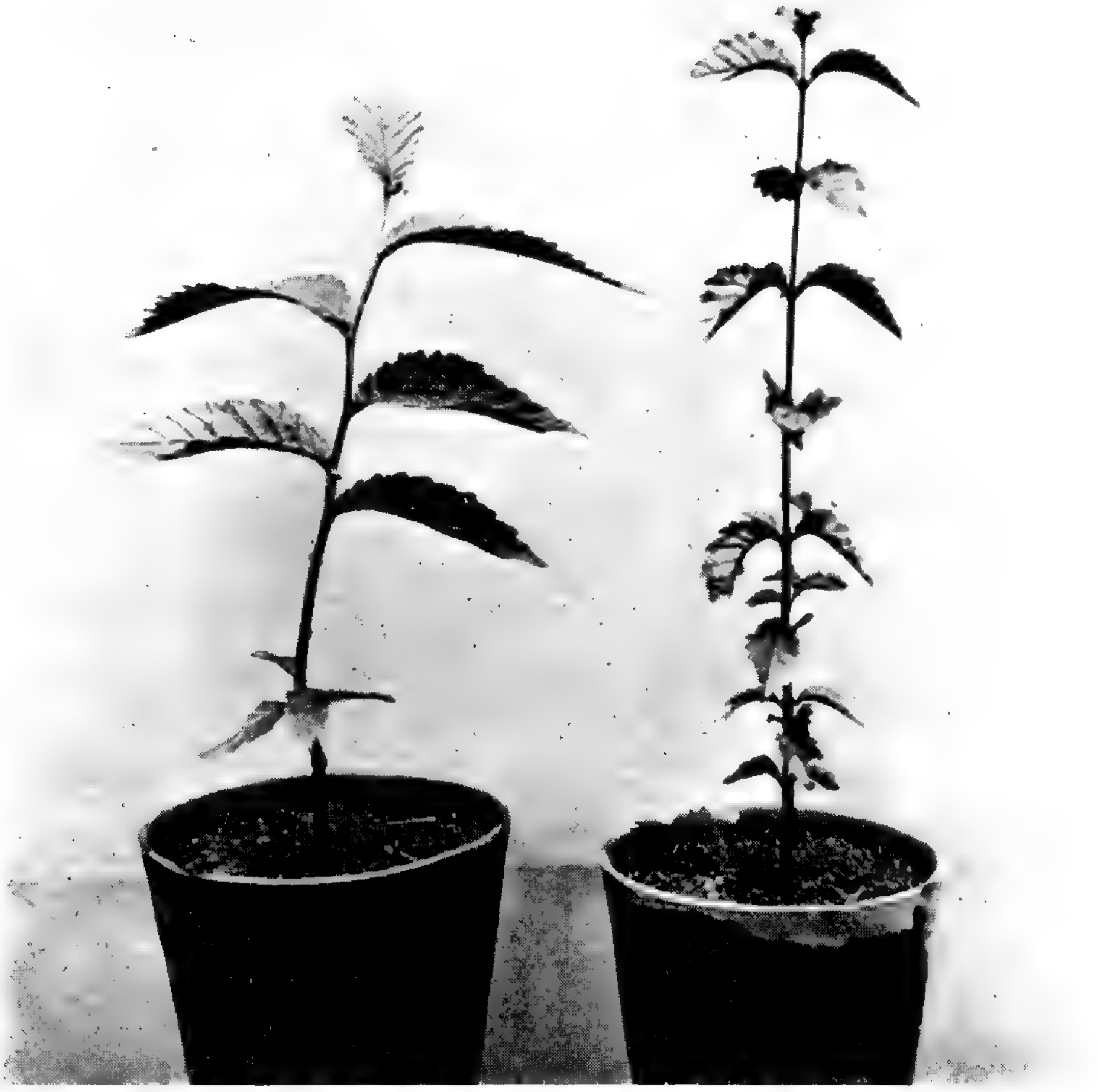
Grout, sc.

THE HUNTINGDON ELM.


U · GLABRA ·
U · MONTANA ·
HUNTINGDON ELM ·
U · GLABRA × U · MONTANA ·

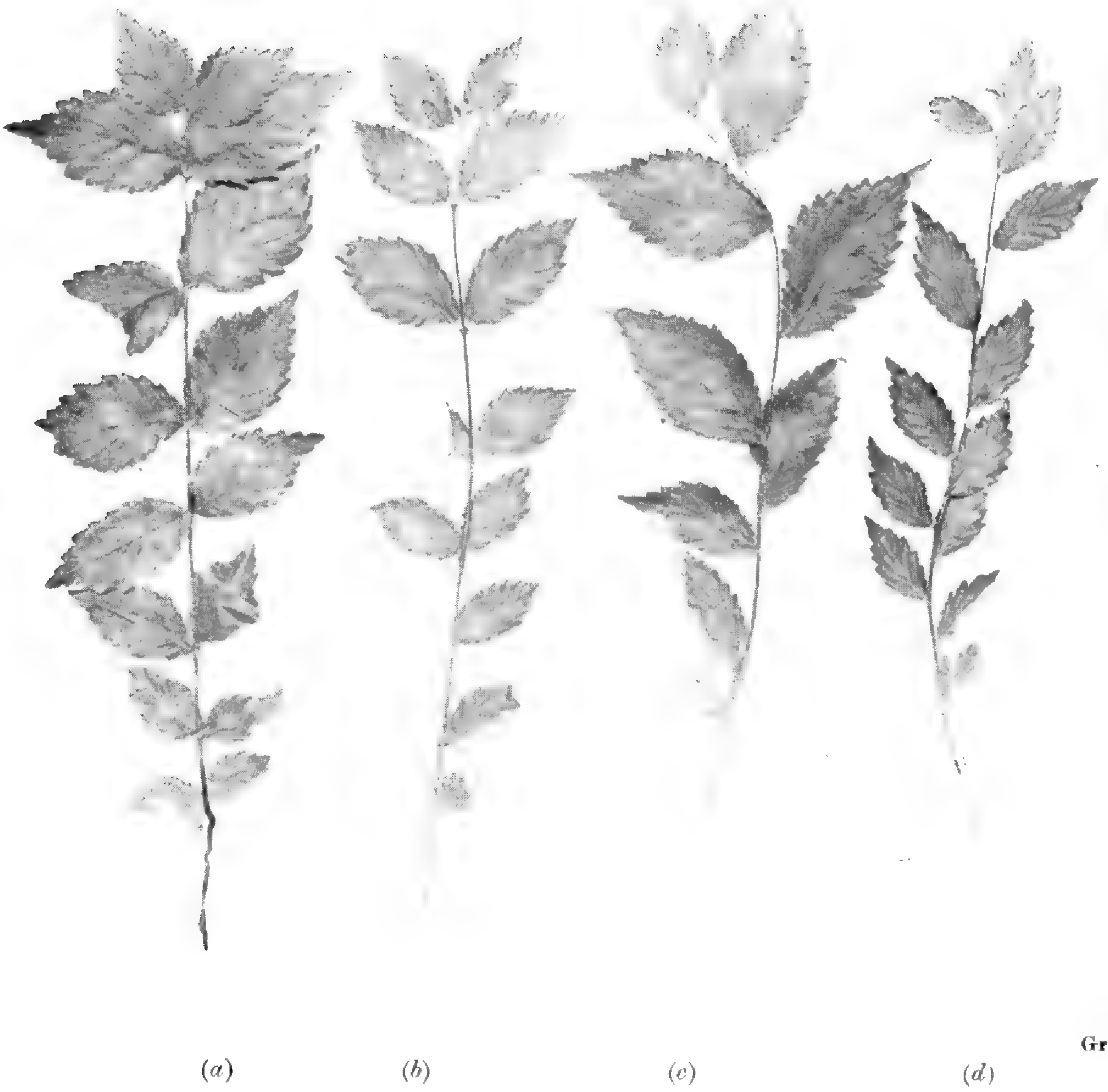
Grout, sc.

ADULT FOLIAGE OF ELMS.



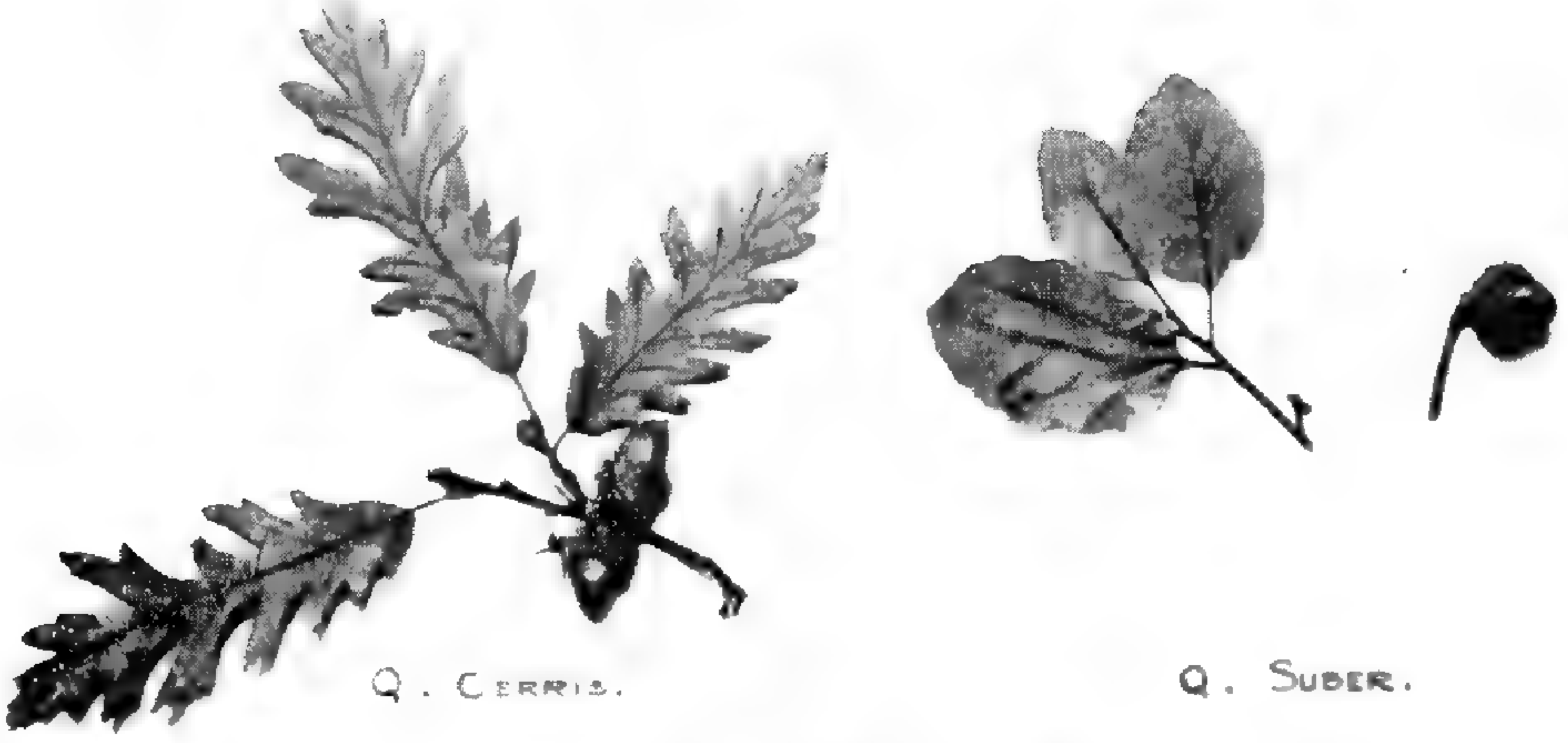
Grout, sc.

SEEDLINGS OF *ULMUS.*

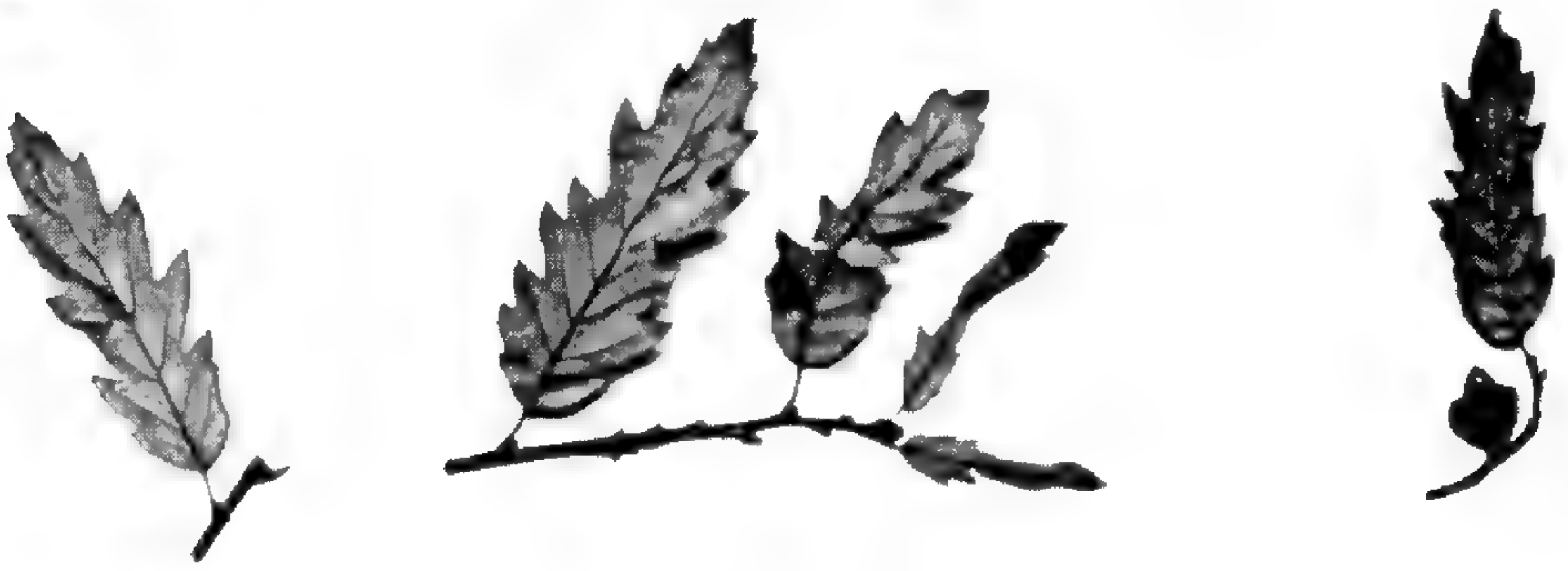


Grout, sc.

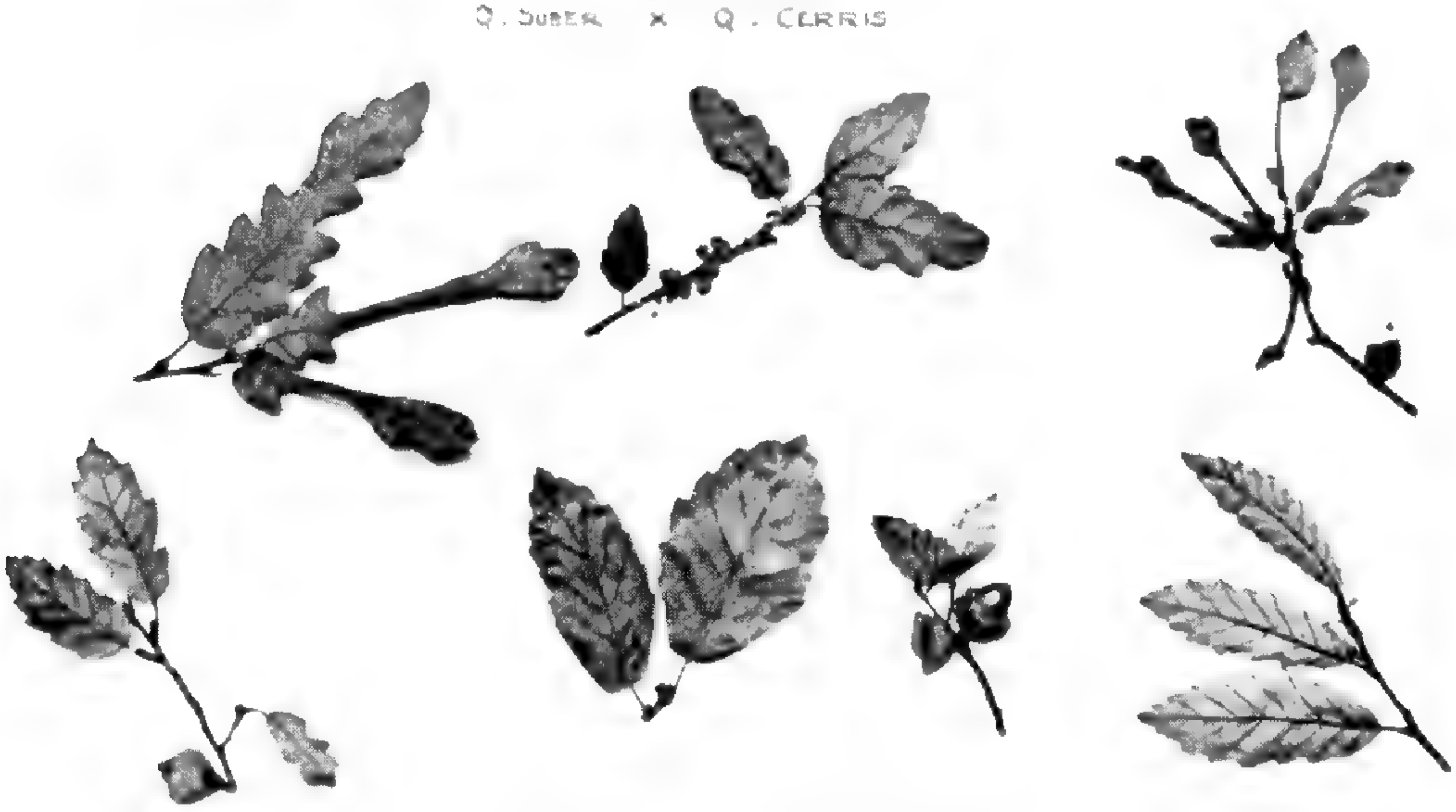
SEEDLINGS OF THE HUNTINGDON ELM.



Q. Cerris. Q. Suber.



Q. Lucombeana
Q. Suber × Q. Cerris



Seedlings of Q. Lucombeana.

Grout, sc.

THE LUCOMBE OAK.

Male Sterility in Potatoes, a dominant Mendelian character; with Remarks on the Shape of the Pollen in Wild and Domestic Varieties. By Dr. REDCLIFFE N. SALAMAN. (Communicated by Mr. ARTHUR W. SUTTON, F.L.S.)

[Read 18th June, 1910.]

DARWIN [*], in considering the origin of sterility, describes a condition of anther not uncommonly found amongst the Caryophyllaceæ, Liliaceæ, and Ericaceæ. The anther in this condition is more or less shrivelled up or aborted and contains no pollen. Darwin gave the condition the name "contabescence," and he described how it might be propagated by "layers," "cuttings," etc., and even perhaps by seed.

C. F. Gärtner [†] first observed the condition and considered it due to an inherent tendency in the species to become diœcious; he also describes the sudden appearance of sterility in the female organs.

Bateson [‡] observed the same phenomenon in the Sweet Pea, and found it was associated with coloured axils in certain families and was recessive to fertile anthers. Working for some time on the heredity of colour and other characters in Potatoes, I have met the phenomenon of contabescence and have been able to show that it is in the Potato a dominant hereditary character. No association has been clearly established between this condition and any other feature; but so far I have not met with a pale heliotrope potato-flower, such as seen in "Up-to-date," that bears pollen in its anthers, and, further, such heliotrope flowers as I have been able to analyse have been always heterozygotes as regards "sterility."

The evidence for the dominance and segregation of this type of sterility is as follows:—

Record × *Flourball.*—The former has empty anthers, the latter abundant pollen. In F^1, 28 plants were raised in 1909, of which 21 bore flowers, all of which were sterile. In 1910, 26 of the F^1 plants flowered and they were all sterile. Two of these latter were fertilized by a derivative of "Flourball" possessing abundant pollen.

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[*] 'Animals and Plants,' 1890, vol. ii. pp. 149.

[†] 'Versuche d. Beobachtungen über Befruchtungsorgane,' Stuttgart, 1844, p. 97.

[‡] Bateson, Saunders, and Punnett: Rep. Evol. Comm. Roy. Soc. 1904, vol. ii. p. 91.

In these families all the flowers were examined, with the following results :—

	Pollen present.	Pollen absent.
$H^1 \times A$	7	12
$H^{10} \times A$	12	8
Total	19	20

The expected ratio being equality.

It is to be observed that of those possessing pollen only seven are classed as containing a " medium " quantity; the remainder have all small quantities. Moreover, the percentage of dead grains throughout is very high, and the quality of the recessive parent " A " is not fully reproduced.

Congo × *Flourball.*—In this case " Congo " is quite sterile. The anthers are not aborted. F^1 consisted of 23 individuals, of which five had no flowers, and of the remaining 18, eight had "abundant" pollen and ten none at all. Two of the F^1 were selfed with the following results :—

	Pollen present.	Pollen absent.
K^6	36	3
K^9	8	0
Total	44	3

Theoretically all should contain pollen, but three plants with normal anthers contained none. Of the remaining 41 plants, four have little, two medium quantities, and thirty-five abundant.

I have at present no explanation to offer for this discrepancy. That " Congo " is heterozygous for sterility is further shown by a second cross, where " Reading Russet " was the pollen parent. Here only three F^1 plants flowered, two contained small quantities of pollen, and one none.

Red Fir Apple × *Reading Russet.*—Red Fir Apple has a small pale heliotrope flower with entirely contabescent anthers. Reading Russet bears an abundance of pollen. Only nine F^1 plants were preserved in 1909, when these pollen observations were being made. Of these, six had no flowers, two had plenty of pollen, and one none. In F^2, of six plants examined, in 1909, all have pollen present. In 1910, 22 more F^2 plants have flowered and all possess a quantity of pollen.

Queen of the Valley × *Flourball.*—Queen of the Valley has heliotrope flowers with pale anthers, having only very little pollen, and that all aborted. The F^1 family were not specially watched for pollen, but there is evidence that whilst some were completely sterile, others had some pollen, whilst an F^1 plant which was sterile × Bohemian Pearl gave a line composed of pollen-bearing plants and sterile plants in about equal numbers.

Recessive "presence" breeds true.—"Flourball," a well-known potato possessing abundant pollen, has been raised by seed through three successive generations, and every member examined possessed pollen except in the instances noted later, and the great majority an abundance of pollen. In one family, 21 members, in another 16 were examined and all contained an abundance of pollen.

The fertility of the female side is apparently entirely independent of that of the male.

QUANTITY OF POLLEN.—Certain empirical standards were taken for gauging the quantity of pollen present, and the following grades were differentiated:—

Abundant: When the anther is full of pollen, and a touch of the needle liberates relatively large quantities of grains.

Medium: When there is about half as much as is described as "abundant," but enough to allow a ready and sufficient supply for examination and fertilization.

Small: When the pollen is present to the naked eye in the opened anther, but the help of a needle is needed to obtain sufficient for examination.

Very few grains: When the anther is practically empty, or rather contains no free pollen, and the few grains that are obtained must be detached from the inner walls of the anther by the needle. This condition is equivalent to the absence of pollen, for such few grains as are obtained are all dead.

QUALITY OF POLLEN.—In examination, the shape and quality of the pollen as a whole, note has been made in each case of the relative quantities of oval, irregular, or round grains when dry, and the percentage of the grains which on addition of water swell up and become globular—*i. e.*, to the quantity of pollen which is living.

The method I use is to shed the pollen from the anther with the help of a needle on to a glass slide and then note its amount, and the relative quantities of elliptical, irregular, and round grains present. A cover-slip with a drop of water is then dropped on to the specimen and a fresh estimate made. These estimates are, in the nature of the method, nothing more than skilled guesses. The large number of estimations made, viz. over 300 in 1909 and 400 in 1910, and the fact that the same pollen was often quite independently examined several times with remarkably similar results, allows the results to be used as a relatively sound basis of comparison, the personal equation being constant throughout the series.

The results of the examinations made in this manner fall readily into three classes. The first class contains those pollens which possess 70 or more per cent. of living grains, and the quality of such a pollen I have, for the purposes of comparison, designated as "α." The second class comprises pollens possessing at least 30 per cent. of living grains and not more than 70, and this condition has been called "β." A third class, made up of those possessing less than 30 per cent. of living pollen, is described as "γ."

Relation of quantity to quality.—There is undoubtedly some correlation between the condition of abundant pollen and pollen of the quality "α." As will be seen in the table given, the "α" standard of quality does not occur except in conjunction with abundance of pollen. On the other hand, abundance of pollen is by no means regularly associated with the α quality. This is particularly striking in the case of *Solanum Maglia*, which, although possessing a very large quantity of pollen, does not possess more than 15 per cent. of living grain.

The following table will show those points perhaps more clearly :—

Number.	Family.	No. of Plants examined.	Quantity.			Quality.		
			Abund.	Medium.	None or small.	α.	β.	γ.
A	Flourball	21	21	..	..	6	9	6
*K^6	F^2 of Congo × Flourball seedling.	46	25	..	..	14	9	2
				14	..	..	10	4
					7	..	6	1
K^9	F^2 of Congo × Flourball seedling.	8	7	..	..	3	4	
				1	..	..	1	
H^1×A	F^1 of (Record × Flourball) Flourball seedling.	19	..	3	..	..	3	
					4 small.			
					12 none.			
H^{10}×A	F^1 of (Record × Flourball) Flourball seedling.	20	..	4	..	..	4	
					8 small.			
					8 none.			

Of the 53 instances of abundant pollen given above, there were only two which possessed pollen of extremely poor quality, and these were :—

K^6 .... No. 1. Abundant pollen, all dead.
K^9 .... No. 133. „ „ 98 per cent. dead.

The Appearance of Male Sterility in Fertile Lines.

So far we have dealt with "presence" or "absence" of pollen as the main feature of male sterility. In the following is evidence of the sudden appearance of sterility due to the "quality" of the pollen and only partially associated with "absence" of pollen, and not at all with deformity of the anther.

The variety known as Sutton's Flourball, which has been extensively used in my potato experiments, is a red-skinned variety which flowers freely, sets seed readily, and has abundant pollen of a high quality. In 1906 a flower of this variety was selfed, producing 200 seedlings, and from one of the white-tubered seedlings, viz. D 1907, which arose from it in 1907, a selfed fruit was obtained ; this contained only about a dozen seeds, and only five of these seeds germinated, of which two bore tubers, viz. D^1 1908 and D^2 1908. In 1909 both D^1 and D^2 were grown and were fairly vigorous plants flowering freely, but they possessed only a medium quantity of pollen, and that entirely dead. Repeated endeavours failed to self-fertilize flowers of either of these two plants.

D 1907 was grown on in 1908, and a selfed ball obtained which contained only ten seed, of which only four germinated, and although every effort was made to keep and protect these seedlings they failed to flower.

D 1907, grown again in 1909, produced after many efforts at fertilization two seed-balls, but they contain relatively few and rather immature-looking seed.

A similar tendency to become sterile on the male side was found in another line "G" isolated from Sutton's Flourball. In 1907, 150 seedlings were raised, and one of these selfed, giving in 1908 seven seedlings : two were white, five red tubers. The red-tubered plants in 1909 bore flowers with abundant and good quality pollen ; the white-tubered ones, G^1 and G^2, bore also abundant flowers and were self-fertilized many times, but their pollen though fair in quantity was very bad in quality, and only one seed-ball, which, however, contained a good member of immature seed, was obtained from G^1. G^2 bore no fruit. In 1910, families of seedlings were raised both from G^3 and G^4, red-tubered plants, and in both there were many individuals who possessed but very poor pollen, *i. e.* it was mostly dead, whilst in a few there was no pollen formed. Deformity, however, was not observed in any of the anthers.

If Table IV. of pollen examinations be now studied, it will be seen how variable the pollen is in these two lines D and G, and what a strong tendency there is towards the formation of "round" pollen in the dry state, a fact which I think undoubtedly points to some condition inhibiting the manufacture of perfect pollen.

In both D and G we have two lines starting as highly fertile, and, in both, plants arise which have a tendency towards the production of sterile pollen, which in a subsequent generation produce individuals with complete male sterility as regards "quality" of pollen.

It was pointed out earlier in this paper that out of 53 plants which all had "abundant" and were expected to have fertile pollen, there were two which were almost completely sterile—viz. K6.1 and K6.133, *i. e.* their pollen was non-viable.

Pollen Shapes.—The results of my work in this direction are not altogether in accordance with the results of Mr. Sutton (to whom I am very much indebted for specimens of wild species and friendly criticism), as recorded in his recent paper* on "Wild Forms and Species of Tuber-bearing *Solanum*." In this paper Mr. Sutton states:—"The pollen-grains of all wild species are of one particular shape, namely elliptical, whereas the pollen-grains of all cultivated potatoes which I have examined are very irregular in form and size and very 'degenerate.'"

My observations concern the following, viz.:—wild types *Solanum verrucosum*, *S. tuberosum*, *S. Maglia*, *S. etuberosum* Lindsay, a number of commercial potatoes, in addition to about 300 different plants which have arisen out of my research. For purposes of comparison the wild *S. nigrum* has also been examined from time to time.

Shape of Grain.—The "normal" grain is oval or elliptical with truncated ends. It is like a partially deflated gas-bag, in which two folds are made on either side of a vertical axis, converting a potential sphere into an almost flat and nearly rectangular body.

The irregular grains are sometimes longer than the elliptic, but the majority are smaller; they may be almost any shape, from nearly round to nearly oval, but of smaller size than the normal, and from almost square to an irregular pebble-shape. Some of the irregular grains are imperfectly or incompletely folded grains.

Rounded grains are found in greatest quantity where the pollen is so scanty as to need scraping out of the anther; they are always covered with tags of cellular tissue, and are immature pollen-cells. The circular grains are generally opaque and abnormal, but a few will swell and appear as healthy as those which were previously oval. Their protoplasm is, however, more coarsely granular, their size smaller, and instead of being colourless they have a yellow tint.

When the water is added all the oval grains at once become circular and are seen to be filled out with a finely granular substance, whilst the three apertures are at once obvious.

The irregular grains retain their irregular shape, and are seen to be empty or to contain but a small bubble of air. Some few of the imperfectly folded grains may swell up into round ones.

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* Journ. Linn. Soc., Bot. vol. xxxviii. 1909, pp. 446–453.

These differences of shape were found in the wild species as well as in the cultivated, but I have come across examples, such as specimens K^6 (F^1, Congo × Flourball), $K9^2$, 40 (F^2 of same cross), and several others, which have pollen quite as perfect and more abundant than any wild type.

On the other hand, the majority of the commercial potatoes have but little pollen, and what there is consists largely of irregular grains which, it must be remembered, are sterile aborted grains. Notable exceptions are Flourball, Early Regent, and Reading Russet.

In Table I. is given a list of the wild forms, and in Table II. a few of the domestic potatoes, and examples of those that have arisen in the course of my experimental work on the domestic varieties.

It will be seen from the tables that there is no essential difference whatever between the wild species and the domestic varieties. Thus *S. Commersonii*, which is one of the most distinct forms, is not so pure to the oval type as many domestic sorts, such as Flourball or Reading Russet. *S. tuberosum* is the most completely oval, but, even so, it is with difficulty to be differentiated, in respect of purity and shape, from K^6 (F^1, Congo × Flourball). The grains of the latter are, however, larger and far more abundant than those of *S. tuberosum*.

The irregular grains of *S. Commersonii* and the other species are not to be distinguished from the irregular grains of any domestic variety which has plenty of pollen; they should not, however, be compared with the irregular grains of those varieties which, having but few grains in the anther, are practically sterile, for these few grains are often imperfect mother-cells, and frequently are twin-cells.

Mr. Sutton * has described the variety which was identified as *Solanum etuberosum* † by Mr. Lindsay of the Edin. Bot. Gardens, and has kindly visited my garden in order to make sure of the identity of the potato obtained from Kew, and grown by myself, with that which he has grown at Reading during the last twenty years. The two potatoes are in his and my opinion without doubt the same. As my observations on the pollen of this variety and its seedlings vary a little from those of Mr. Sutton's, it has seemed best to add here a short description of my findings, though I hope to publish later a fuller note on this variety ‡.

S. etuberosum set seed in my garden in 1908, and in 1909 some 50 seedlings were grown showing a degree of variation that was as extraordinary as it was unexpected.

The pollen of the parent plant was examined at various intervals during the summer of 1909, and, as is shown in the table, deteriorated as the season progressed, yet in the early part the almost complete uniformity of the pure oval type coincides with that described by Mr. Sutton. The seedlings when examined (see Table III.) at varying intervals show the same phenomena of degeneration in quality of pollen.

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* Journ. Linn. Soc., Bot. vol. xxxviii. 1909, p. 448, tab. 46.

† Although styled "*etuberosum*" there is no doubt that it is not the potato so described by Lindley.

‡ Journ. Genetics, 1910, vol. i.

Amongst the seedlings are some with pollen as good as the parent and some as poor in quality as the worst of our domestic varieties. The best seedlings, such as Nos. 3 and 45, compare very favourably with the wild species examined, and require some careful examination to discover the irregular forms, whilst No. 23 and, more especially, No. 24 are composed almost entirely of irregular forms.

These considerations lead one to conclude that the normal shape of dry potato-pollen is oval. Irregular grains are either aborted or immature grains, and are a measure rather of the male sterility of the variety than any indication of varietal or specific difference. The presence of irregular grains in the seedlings of *etuberosum* is no evidence for or against this variety being the parent of our domestic potatoes, for such irregularity is present in the parent *etuberosum* as well as in all the wild species examined.

Conclusions.

1. The normal pollen-grain of both wild and domesticated potatoes when dry is oval.
2. Irregular grains are immature or dead grains.
3. The presence of irregular grains is not a sign of varietal difference, but rather a measure of sterility.
4. The absence of pollen in the anther is dominant to its presence.
5. The characters, absence and presence, of pollen segregate in subsequent generations.
6. The number of living grains in an anther is correlated generally with the total quantity of pollen present, but exceptions occur.
7. Pale heliotrope potato-flowers have always been found to be sterile, and, so far as here investigated, heterozygous as regards sterility.
8. The later in the season the flowers are examined, the more likely is the quality of the pollen to deteriorate.
9. Sterility may arise suddenly in an individual member of a family possessing a very high degree of fertility.

I should like here to express my appreciation of the valuable help that my head gardener, Mr. E. Jones, has always rendered me.

TABLE I.

				←Dry		→	←Wet			→
NAME.	Colour of Flower.	DATE 1909.	Amount of Pollen.	Irreg. per cent.	Oval per cent.	Round per cent.	Irreg. per cent.	Oval per cent.	Round per cent.	Dead per cent.
S. Commersonii	White.	August 8.	Abundant.	25	75	..	40	..	60	40
S. Commersonii	White.	August 25.	Abundant.	60	40	..	60	..	40	60
S. Maglia	White.	August 25.	Little.	70	*30	..	35	50	15	85
S. tuberosum	Purple.	August 25.	Abundant.	10	90	..	10	..	90	10
S. verrucosum	Deep Purple.	August 25.	Abundant.	15	†85	..	60	..	40	60
S. etuberosum............	Lilac.	Sept. 21.	Abundant.	1	99	..	1	..	99	1
S. etuberosum	Lilac.	August 29.	Abundant.	30	70	..	30	..	70	30
‡ *S. nigrum*	White.	August 13.	Abundant.	5	95	..	5	..	95	5

* The ovals are to the extent of 50 per cent. of their number shrivelled and dead. The irregulars are also largely composed of shrivelled up ovals. The grains are smaller than in the other species or domestic varieties.

† The ovals are to the extent of 50 per cent. practically the same shape as in all the other species and varieties, and as to the remaining 50 per cent. are broader and more pyramidal, many of them are apparently dead.

‡ Have same shape exactly as the varieties of the potatoes and are about the same size. Examined several different times; some few dead grains were always found.

TABLE II.

				← Dry	→		← Wet		→	
NAME.	Colour of Flower.	DATE 1909.	Amount of Pollen.	Irreg. per cent.	Oval per cent.	Round per cent.	Irreg. per cent.	Oval per cent.	Round per cent.	Dead per cent.
Queen of Valley	Heliotrope.	....	Few grains.	60	..	40	60	..	40	99
Duch. Cornwall	Heliotrope.	July 21.	Few grains.	100	..	..	100	..	..	100
Supreme	White.	July 21.	Few grains.	50	..	50	50	..	*50	100
Peckover	White.	July 21.	Few grains.	50	..	50	50	..	*50	100
Up-to-date	Heliotrope.	July 25.	Few grains.	75	..	25	75	..	*25	100
K 9^2 49	White.	August 11.	Abundant.	10	90	..	10	..	90	10
K 6^2 100	White.	August 10.	Abundant.	20	80	..	20	..	80	20
K 6	White with Purple centre.	July 19.	Abundant.	5	95	..	5	..	95	5
A 46	White.	August 11.	Abundant.	15	80	5	20	..	80	20
Reading Russet	White.	....	Abundant.	20	80	..	20	..	80	20
Flourball Types, A and G^4	White.	July 29.	Abundant.	10	90	..	10	..	90	10

* Round but not swollen grains.

TABLE III.

				← Dry		→	← Wet			→
NAME.	Colour of Flower.	DATE 1909.	Amount of Pollen.	Irreg. per cent.	Oval per cent.	Round per cent.	Irreg. per cent.	Oval per cent.	Round per cent.	Dead per cent.
S. etuberosum. Parent plant ..	Lilac.	July 21.	Abundant.	1	99	..	1	..	99	1
S. etuberosum	Lilac.	August ?	Abundant.	5	95	..	5	..	95	5
S. etuberosum	Lilac.	August 29.	Abundant.	30	70	..	30	..	70	30
S. etuberosum. No. 3	White.	July 21.	Abundant.	5	95	..	5	..	95	5
S. etuberosum. No. 4	White.	August 14.	Abundant.	95	5	..	95	..	5	95
S. etuberosum. No. 15	White.	August 8.	Abundant.	10	90	..	10	..	90	10
S. etuberosum. No. 15	White.	August 30.	Abundant.	33	35	*34	33	..	67	33
S. etuberosum. No. 20	White and Purple.	August 14.	?	40	30	*30	40	..	*60	40
S. etuberosum. No. 23	Purple.	August 30.	Abundant.	67	33	..	67	..	33	67
S. etuberosum. No. 25	Lilac.	August 8.	Abundant.	30	70	..	30	..	70	30
S. etuberosum. No. 28	Lilac.	August 14.	Abundant.	20	40	*40	40	..	60	40
S. etuberosum. No. 30	Lilac.	August 31.	Abundant.	40	60	..	40	..	60	40
S. etuberosum. No. 31	Lilac.	August 8.	Fair.	60	40	..	60	..	40	60
S. etuberosum. No. 35	Purple.	August 30.	Abundant.	33	67	..	33	..	67	33
S. etuberosum. No. 36	Pale Lilac.	August 8.	Abundant.	35	75	..	25	..	75	25
S. etuberosum. No. 45	Lilac.	August 2.	Abundant.	5	95	..	5	..	95	5
S. etuberosum. No. 45	Lilac.	August 8.	Abundant.	5	95	..	5	..	95	5
S. etuberosum. No. 45	Lilac.	August 13.	Abundant.	10	90	..	10	..	90	10
S. etuberosum. No. 46	Lilac.	August 14.	Abundant.	10	90	..	10	..	90	10

* These round cells are immature pollen-grains and pollen mother-cells.

TABLE IV.

				← DRY	→		← WET		→	
NAME.	Colour of Flower.	DATE 1909.	Amount of Pollen.	Irreg. per cent.	Oval per cent.	Round per cent.	Irreg. per cent.	Oval per cent.	Round per cent.	Dead per cent.
D 1907	White.	August 2.	Abundant.	80	20	..	80	..	20	80
D 1907	White.	August 4.	Medium.	90	10	..	80	..	20	80
D^1 1908	White.	July 19.	Medium.	50	..	50	80	..	20†	100
D^1 1908	White.	July 31.	Medium.	50	..	50	20	..	80†	100
D^2 1908	White.	August 2.	Medium.	60	..	40	10	..	90†	100
D^2 1908	White.	July 31.	Small.	40	..	60	20	..	80†	100
G^1 1908	White.	July 29.	Medium.	60	40*	..	50	40	10‡	99
G^1 1908	White.	August 2.	Abundant.	25	75	..	30	..	70‡	30
G^1 1908	White.	August 4.	Abundant.	90	10	..	80	..	20‡	85
G^2 1908	White.	July 29.	Medium.	80	..	20	70	..	30‡	95
G^2 1908	White.	August 2.	Medium.	95	5	..	90	..	10‡	95
G^2 1908	White.	August 4.	Medium.	90	5	5	90	..	10‡	95

* Shrivelled.

† Round but not swollen with granular contents.

‡ Some swollen and granular, others round but not swollen.

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Flora of the Falkland Islands.

By C. H. Wright, A.L.S.

[Read 19th January, 1911.]

During the determination of a collection of plants made in the Falkland Islands by Mrs. Eleanor Vallentin, it occurred to me that it might be interesting to attempt an enumeration of the plants of those islands with a view to show the changes which have taken place in the flora since the publication of the 'Flora Antarctica' by Sir J. D. Hooker in 1847, and also to define more exactly the distribution of the plants in the islands. Many of Mrs. Vallentin's specimens were accompanied by notes which are inserted under the respective species in the following list, and many were accompanied by coloured drawings. A collection made by Miss Firmin in 1895 is also included.

The chief characteristic of the flora is that it consists principally of plants of dwarf habit; trees are quite absent. The tallest species is *Veronica elliptica*, Forst. f., which is a shrub attaining a height of 7 feet, and next to this *Chiliotrichum amelloideum*, Cass., which reaches 5 feet, and is known as the "Fâchima." The main flowering season is from November to January, but the earliest flower to appear is *Draba funiculosa*, Hook. f., which opens in September.

Poa flabellata, Hook. f., the Tussac Grass, which was formerly very abundant, is rapidly being exterminated through the ravages of cattle. *Hierochloe magellanica*, Hook. f., formerly abundant, is now rare. *Primula magellanica*, Linn., used to grow to a height of 1½ to 2 feet, when Mrs. Vallentin's father, Mr. W. Wickham Bertrand, settled in the islands about 40 years ago, but since the introduction of sheep it has dwindled not only in height but also in the size of its flowers, but is still to be found with its former dimensions on those islets where there are no sheep.

A few species, of which I have not seen Falkland Island specimens, but which are recorded by Mr. Macloskie in his "Flora Patagonica" in the Report of the Princeton University Expedition to Patagonia, vol. viii. (1903–6), are included here.

A revision of the flora was published by M. L. Crié in vol. lxxxvii. (1878) pp. 530–533 of the 'Comptes Rendus' of the French Academy, and an interesting account of the vegetation around Port Stanley has been published by Herr Selim Birger in Engler's 'Botanische Jahrbücher,' xxxix. (1906) pp. 275–305.

Ranunculus biternatus, Sm. in Rees, Cyclop. xxxix. n. 48; Hook. Ic. Plant. t. 497; Hook. f. Fl. Ant. ii. 224; Macloskie, Fl. Patag. viii. 406. *R. exiguus*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 615; Gaud. in Freyc. Voy. Bot. 136.

Hooker! *Firmin*! *Nichol*, 32 bis! 33! 35! East Falklands; Mount William, *Cunningham*! West Falklands, marshy ground, *Vallentin*, 20!

South Georgia, Fuegia, Chile.

Ranunculus sericocephalus, Hook. f. Fl. Ant. ii. 225, t. 83; Macloskie, Fl. Patag. viii. 412.

Hooker! *Chartres*! *Lyall*! East Falklands; Stanley, *Vallentin*, 107! West Falklands; Roy Cove, *Vallentin*!

Leaves hirsute. Flowers yellow.

Ranunculus Maclovianus, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 615; Gaud. in Freyc. Voy. Bot. 136; Hook. f. Fl. Ant. ii. 225; Macloskie, Fl. Patag. viii. 410.

East and West Falklands, in swamps, *Hooker*! *Vallentin*, 19! *Nichol*!

Ranunculus hydrophilus, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 105, and in Freyc. Voy. Bot. 136, 175; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 515; Hook. f. Fl. Ant. ii. 226, t. 82, fig. B; Macloskie, Fl. Patag. viii. 409.

Gaudichaud, *D'Urville*, *Hooker*.

Ranunculus trullifolius, Hook. f. Fl. Ant. ii. 226, t. 82, fig. A.

East Falklands; St. Salvador Bay, *Hooker*!

Hamadryas argentea, Hook. f. Fl. Ant. ii. 227, t. 85; Macloskie, Fl. Patag. viii. 413.

Hooker! *Sullivan*, *Robinson*. West Falklands; Roy Cove, *Vallentin*, 17! dry hill-slopes, *Firmin*, 51!

Magellan.

Leaves woolly, whitish green. Flowers greenish yellow, December.

Caltha sagittata, Cav. Ic. t. 414; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 105, and in Freyc. Voy. Bot. 136; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 615; Hook. f. in Bot. Mag. t. 4056, and in Fl. Ant. ii. 228; Macloskie, Fl. Patag. viii. 400.

Hooker! East Falklands; Stanley, *Cunningham*! Darwin Green, *Vallentin*! West Falklands; Chartres River, *Vallentin*, 67! Port North Ponds, Roy Cove, *Vallentin*!

Leaves brilliant shining green. Flowers greenish white, Nov.–Dec.

Growing in swamps, streams and ponds; varying in size according to locality.

Caltha appendiculata, Pers. Syn. ii. 107; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 615; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 105, and in Freyc. Voy. Bot. 136; Hook. f. Fl. Ant. ii. 228; Macloskie, Fl. Patag. viii. 399.

Gaudichaud, *D'Urville*, *Hooker*!

Fuegia, Hermite Island.

Arabis macloviana, Hook. Ic. Plant. t. 428; Hook. f. Fl. Ant. ii. 232. *Brassica magellanica*, Poir. fide Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 105, non alior.; Macloskie, Fl. Patag. viii. 432. *B. Macloviana*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 616. *Erysimum Macloviana*, Gay in Ann. Sci. Nat. 1re sér. viii. (1826) 392, in obs.; Gaud. in Freyc. Voy. Bot. 136. *Sophia Macloviana*, Gay ex Hook. f., l. c.

Gaudichaud, *D'Urville*, *Nichol*! West Falklands; near the sea-shore, Crooked Inlet, Roy Cove, *Vallentin*, 13!

Flowers small, white, Nov.–Dec.

Cardamine hirsuta, Linn. Sp. Pl. ed. I. 655; Gaud. in Freyc. Voy. Bot. 137; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 616. *C. antiscorbutica*, Banks & Sol. ex Griseb. in Goett. Abh. vi. (1854) 115. *C. glacialis*, DC. Syst. Veg. ii. 264; Prodr. i. 264; Macloskie, Fl. Patag. viii. 437. *C. propinqua*, Carmichael in Trans. Linn. Soc. xii. (1819) 507. *Sisymbrium glaciale*, Forst. in Comm. Goett. ix. (1789) 32.

East and West Falklands; common in moist places, *Hooker*! *Nichol*! West Falklands; Chartres River, *Vallentin*, 1!

Flowers small, white.

[**Cochlearia officinalis**, Linn. Sp. Pl. ed. I. 647.

West Falklands; Port North beach, Roy Cove, growing sparsely in sand, *Vallentin*, 111!

Fuegia. North temperate and arctic regions.

Flowering in Dec. Probably introduced.]

Draba funiculosa, Hook. f. Fl. Ant. ii. 235, 238; Macloskie, Fl. Patag. viii. 443.

Hooker, 74! *Abbott*! *Nichol*! West Falklands, *Vallentin*, 63!

Flowers white, Sept.–Oct. The earliest spring flower.

Draba falklandica, Hook. f. Fl. Ant. ii. 238; Macloskie, Fl. Patag. viii. 443.

Robinson!

Viola maculata, Cav. Ic. vi. 20, t. 539; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 617; Gaud. in Freyc. Voy. Bot. 137; Hook. Ic. Pl. t. 499; Hook. f. Fl. Ant. ii. 244.

East and West Falklands; near beaches, fairly common, *Vallentin*, 9! *Hooker*, 76! *Abbott*! *Firmin*, 30! *Nichol*!

Yellow, scentless.

Viola tridentata, Menz. ex DC. Prod. i. 300; Hook. f. Fl. Ant. ii. 245.

Falkland Islands; on the mountains, 1200–1500 ft., *Hooker*!

Staten Land, Port Famine, Hermite Island.

Sagina procumbens, Linn. Sp. Pl. ed. I. 128; Gaud. in Ann. Sci. Nat. 1^re^ sér. v. (1825) 105, and in Freyc. Voy. Bot. 137; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 617; Hook. f. Fl. Ant. ii. 247.

East and West Falklands; fairly common near the sea, sometimes in cultivated places, *Vallentin*, 34! *Firmin*, 37! *Nichol*! All collectors.

North temperate region.

Colobanthus crassifolius, Hook. f. Fl. Ant. ii. 248.

D'Urville, *Hooker*!

Port Famine, Hermite Island.

Colobanthus subulatus, Hook. f. Fl. Ant. i. 13, ii. 247; Macloskie, Fl. Patag. viii. 392. *C. Benthamianus*, Fenzl in Ann. Wien. Mus. i. (1836) 49. *Sagina subulata*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 617; Hook. f. Fl. Ant. ii. t. 93.

West Falklands, scarce, *Hooker*! *Vallentin*, 32! *Nichol*!

Stellaria debilis, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 618; Hook. f. Fl. Ant. ii. 250. *Alsine debilis*, Macloskie, Fl. Patag. viii. 386.

Falkland Islands, by the margins of rivulets, not uncommon, *D'Urville*, *Hooker*!

Staten Land.

[**Stellaria media,** Cyrill. Char. Comm. 36; Hook. f. Fl. Ant. i. 8, ii. 250. Introduced.]

Arenaria media, Linn., var. β, Hook. f. Fl. Ant. ii. 250.

East Falklands; St. Salvador Bay, *Hooker*!

Cerastium vulgatum, Linn. Fl. Suec. ed. II. 158; Hook. f. Fl. Ant. ii. 251; Macloskie, Fl. Patag. viii. 390.

East Falklands, *Lechler*! near Port Louis, *Hooker*! West Falklands, abundant, *Vallentin*!

Cerastium arvense, var. **strictum**, Hook. f. Fl. Ant. ii. 251; Macloskie, Fl. Patag. viii. 388.

East and West Falklands, common, *Gaudichaud*, *Hooker*, 87! *Vallentin*, 26! *Nichol*!

Flowers white, delightfully fragrant.

Montia fontana, Linn. Sp. Pl. ed. I. 87 ; Hook. f. Fl. Ant. ii. 278.

D'Urville, *Hooker*! *Vallentin*! *Nichol*!

Europe, temperate Asia, New Zealand, Kerguelen Is., N. and S. America.

Oxalis enneaphylla, Cav. Ic. v. 7, t. 411 ; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 105, and in Freyc. Voy. Bot. 137 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 616; Hook. f. Fl. Ant. ii. 253.

East and West Falklands, common, *Abbott*! *Wright*! *Hooker*, 69! *Firmin*, 22! *Nichol*! *Cunningham* (Stanley)! *Vallentin*, 18!

Antiscorbutic. A delicious and refreshing drink can be made from the stalks. Flowers scented, white, pink or mauve; Dec.–Jan.

Rubus geoides, Sm. Ic. Ined. t. 19 ; Hook. f. Fl. Ant. ii. 263. *R. antarcticus*, Banks & Soland. ex Hook. f. l. c. *Dalibarda geoides*, Pers. Syn. ii. 53 ; Gaud. in Ann. Sci. Nat. 1re sér. iv. (1825) 106, and in Freyc. Voy. Bot. 138 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 620.

Nichol! East Falklands; abundant by rivers at Berkeley Sound, *Vallentin*, 16! West Falklands; Mount Cook, Roy Cove, *Vallentin*!

Flowers white, Nov.–Jan. Fruit resembling wine-berries in appearance and almost as large as raspberries, with a delicious flavour, ripening Jan.–Feb.

Magellan Straits, Port Famine, Good Success Bay.

Acæna ascendens, Vahl, Enum. i. 297 ; Hook. f. Fl. Ant. ii. 268; Macloskie Fl. Patag. viii. 477. *Ancistrum humile*, Pers. Syn. i. 30.

Abundant, *Gaudichaud*! *D'Urville*, *Firmin*, 13!

Magellan, Good Success Bay, South Georgia.

Acæna lucida, Vahl, Enum. i. 296 ; Lam. Ill. i. t. 22, fig. 3 ; Hook. f. Fl. Ant. ii. 266, t. 94.

Abundant, *Hooker*! Common on dry ground, *Vallentin*, 11! *Nichol*!

Flowers greenish bronze.

Acæna lævigata, Ait. Hort. Kew. ed. 2, i. 68 ; Hook. f. Fl. Ant. ii. 267.

Hooker! *Lyall*! *Chartres*! *Nichol*! West Falklands; near streams, Roy Cove, *Vallentin*, 10!

Grows to a good height in sheltered valleys. The crimson heads of flowers are very striking.

Magellan, Hermite Island.

Saxifraga magellanica, Poir. Encycl. vi. 686. *S. exarata*, Hook. f. Fl. Ant. ii. 280, partly. *S. Cordillerarum*, var. *magellanica*, Engl. Monogr. Saxifr. 183.

East Falklands, *Hooker* ! *Darwin*, *Vallentin*, 45 !

Fuegia.

Drosera uniflora, Willd. Enum. Hort. Berol. 340 ; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 105, and in Freyc. Voy. Bot. 137 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 617 ; Macloskie, Fl. Patag. viii. 455.

Gaudichaud, *D'Urville*, *Hooker* !

Port Famine, South Fuegia.

Myriophyllum elatinoides, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 105, and in Freyc. Voy. Bot. 480 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 618 ; Hook. f. Fl. Ant. ii. 271. *M. ternatum*, Gaud. ll. cc. ; Urv. l. c.

West Falklands ; Port North Roads, Roy Cove, in fresh-water lagoons, *Vallentin*, 65 !

Abundant in Hooker's time, now rare.

Epilobium tetragonum, Linn., var. **antarcticum**, Hook. f. Fl. Ant. ii. 270.

Hooker ! *Chartres* !

Tierra del Fuego.

Gunnera magellanica, Lam. Encycl. iii. 61, Ill. t. 801, fig. 2 ; Hook. f. Fl. Ant. ii. 274. *G. falklandica*, Hook. f. Ic. Pl. tt. 489–490. *Misandra magellanica*, Commers. in Juss. Gen. 405 ; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 89, and in Freyc. Voy. Bot. 502 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 621. *Dysemone integrifolia*, Banks & Soland. ex Hook. f. Fl. Ant. ii. 274. "*Mauve*," Pernetty, Voy. ii. 58.

East and West Falklands, common, *Hooker* ! *Collinson*, *Vallentin*, 14 ! *Nichol* !

Very abundant ; eaten by cattle ; locally called "pig oure." Flowers crimson, Nov.–March. Berries brilliant scarlet.

Fuegia, S. Chile.

Myrtus nummularia, Poir. in Lam. Encycl. iv. 407 ; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 106, t. 2, fig. 5, and in Freyc. Voy. Bot. 138 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 619. "*Lucet musque*," Pernetty, Voy. ii. 58.

Common, *Commerson*, *Gaudichaud* ! *Hooker*, 25 ! *Vallentin*, 56 ! *Nichol* ! *Cunningham* ! Tyssen Islands, *Cunningham* !

The islands gained their Spanish name—Islas Malouinas—owing to the Spaniards' non-approval of the tea made from the leaves of this trailing vine.

Flowers white, insignificant. The edible fruit is a most delicate pink where exposed to the sun, but always white on the under side ; aroma delicious.

Fuegia, S. Chile. A variety in Chiloe and the Chonos Archipelago.

Tillæa moschata, DC. Prod. iii. 382. *Bulliarda moschata*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 619 ; Gaud. in Freyc. Voy. Bot. 138 ; Hook. f. Ic. Pl. t. 538, and Fl. Ant. i. 15, ii. 278. *B. magellanica*, DC. Bull. Soc. Philom. (1810) n. 49, p. 2. *Crassula moschata*, Forst. in Comm. Goett. ix. (1789) 26 ; Macloskie, Fl. Patag. viii. 456.

Hooker ! *Wright* ! *Firmin*, 12 ! *Nichol* ! East Falklands, *Cunningham* ! West Falklands ; Roy Cove Creek, *Vallentin*, 39 !

Fuegia, Kerguelen Island, Marion Island, New Zealand.

Callitriche antarctica, Engelm. ex Hegelm. in Verh. Bot. Ver. Brandenb. lx. (1867) 20. *C. verna, β. terrestris*, Hook. f. Fl. Ant. i. 11, ii. 272.

Hooker !

Hermite Island.

Azorella cæspitosa, Cav. Ic. v. 57, t. 484, fig. 2 ; Hook. f. Fl. Ant. ii. 282. *Bolax glebaria*, Commers. ex Lam. Encycl. iii. 156 ; Hook. f. Fl. Ant. ii. 285 ; Birger in Engl. Jahrb. xxxix. (1906) 286.

West Falklands, *Née*, *Sullivan*. Common throughout the islands, *Gaudichaud*, *D'Urville*, *Vallentin*, 76 ! *Firmin* !

Fuegia ; Hermite Island.

The Balsam-bog. "Hillocks 2–4 ft. high, 8–10 ft. long. Hard. Exudes viscid white gum, becoming red-brown on drying."—*Hooker*. Upon bruising or cutting the hard exterior of this plant a rapid decay follows, and within about a year nothing but a heap of mould or fibres is left of a plant which took many years to attain its previous size.

Azorella filamentosa, Lam. Encycl. i. 344, and Illustr. t. 189, fig. 1 ; Hombron & Jacquem. Voy. Pôle Sud, Bot., Dicot. Phan. t. 15 B ; Hook. Ic. Pl. t. 541 ; Hook. f. Fl. Ant. ii. 283. *A. Chamitis*, Pers. Syn. i. 303 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 614 ; Gaud. in Freyc. Voy. Bot. 136. *Chamitis integrifolia*, Gærtn. Fruct. i. 94, t. 22. *Bolax filamentosa*, Spreng. in Schult. Syst. Veg. vi. 359.

Falkland Islands, *D'Urville*, *Chartres* ! *Hooker* ! *Nichol* !

Magellan, Good Success Bay, Port Famine, Hermite Island.

Azorella lycopodioides, Gaud. in Ann. Sci. Nat. 1^re^ sér. v. (1825) 105, t. 3, fig. 1, and in Freyc. Voy. Bot. 136 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 614 ; Hook. f. Fl. Ant. ii. 284. *Chamitis tricuspidata*, Gærtn, Fruct. i. 92. *C. trifurcata*, Banks & Soland.

Abundant, *Gaudichaud*, *D'Urville*, *Firmin*, 23 !

Azorella Ranunculus, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 614; Gaud. in Freyc. Voy. Bot. 136; Hook. f. Fl. Ant. ii. 285, t. 98, fig. 1.

Falkland Islands, by running streams and margins of fresh-water lagoons, *D'Urville, Hooker* !

Apium graveolens, Linn. Sp. Pl. ed. I. 264; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 105, and in Freyc. Voy. Bot. 135; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 613; Hook. f. Fl. Ant. ii. 287.

Hooker, 62! *Vallentin*, 50! *Nichol* !

Europe, the Orient to N.W. India, S. Africa, Tasmania, America from California southwards (excluding the West Indies).

Oreomyrrhis andicola, Endl. Gen. Pl. 787; Hook. f. Fl. Ant. ii. 288. *Caldasia andicola*, Lagasc. ex DC. Coll. Mém. v. t. 2. *Myrrhis andicola*, H. B. & K. Nov. Gen. et Sp. v. 13, t. 419. *Azorella daucoides*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 613.

Abundant in grassy places, *D'Urville, Hooker* ! *Vallentin*, 33! *Nichol* !

Andine region, Australia, New Zealand.

Nertera depressa, Banks & Soland. ex Gærtn. Fruct. i. 124, t. 26; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 104; Hook. f. Fl. Ant. i. 23, ii. 303.

East and West Falklands, in swamps, *Gaudichaud* ! *D'Urville, Hooker* ! *Vallentin*, 47! *Nichol* !

America from Guatemala to Fuegia, Gough Island, Hawaii, Tristan d'Acunha, Australia, New Zealand.

Galium antarcticum, Hook. f. Fl. Ant. ii. 303.

East and West Falklands, in moist places, *Hooker* ! *Vallentin*, 35! *Firmin*, 4! *Nichol* !

Fuegia, Hermite Island, Kerguelen Island.

Nassauvia Gaudichaudii, Cass. ex Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 103, t. 3, fig. 3; Hook. f. Fl. Ant. ii. 319. *Mastigophorus Gaudichaudii*, Cass. in Dict. Sci. Nat. xxxiv. 222.

Gaudichaud ! *Hooker* ! *Chartres* ! *Wright* ! *Nichol* ! East Falklands, *Lechler*, 135! Berkeley Sound, *Darwin* ! Tyssen Islands, *Cunningham* ! West Falklands, *Vallentin*, 31!

"I have never seen this plant on the East Falklands. It grows in irregular masses 2–3 feet in diameter in sunny situations. These masses are densely covered from November to January with myriads of small cream-coloured flowers of a sickly scent."—*Vallentin.*

Nassauvia serpens, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 610 ; Brongn. in Duperrey, Voy., Bot. Phan. t. 56, fig. A ; Hook. f. Fl. Ant. ii. 319, t. 114. *N. D'Urvillei*, Cass. Dict. Sci. Nat. xxxviii. 456.

Hooker ! *Chartres* ! Valleys amongst Fâchima shrubs, also in stone rivers, *Vallentin*, 37 !

This plant is most interesting ; it pushes its serpentine growth upwards through the foliage of Fâchima (*Chiliotrichum amelloideum*, Cass.). It has a most delicious scent, not unlike English lavender. The flowers, which are produced from December to January, are usually white, but occasionally a pale mauve specimen occurs. There is a coloured drawing at Kew made by Capt. Abbott.

Senecio falklandicus, Hook. f. Fl. Ant. ii. 316, t. 110. *S. littoralis*, var. *lanatus*, Gaud. in Ann. Sci. Nat. 1^re^ sér. v. (1825) 104, and in Freyc. Voy. Bot. 468 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 611 ; Hombr. et Jacq. Voy. Pôle Sud, Dicot. t. 10 B. *S. rosmarinus*, Philippi in Anal. Mus. Nac. Chile, 1891, 41.

East Falklands ; Port Stanley, *Lechler*, 143 ! West Falklands ; Port North, *Vallentin*, 22 ! Port William, common close to the sea ; very variable in size and foliage at various heights up to 300 or 400 ft., *Hooker* ! West Falklands ; Fox Bay, *Cunningham* ! *Miss Firmin*, 7 !

Chile.

This plant often grows up to 2 ft. high and makes fine splashes of colour in the camp. Flowers yellow. Leaves woolly and very pale greenish white.

[**Senecio vulgaris**, Linn. Sp. Pl. ed. I. 867 ; Hook. f. Fl. Ant. ii. 313. Falkland Is. ; abundant, but undoubtedly introduced, *Hooker* !]

Senecio littoralis, Gaud. in Ann. Sci. Nat. 1^re^ sér. v. (1825) 104 ; Hook. f. Fl. Ant. ii. 318 ; Macloskie, Fl. Patag. viii. 852.

East Falklands, *Hooker*, 4 ! *Cunningham* ! marshes, *Vallentin*, 74 ! Berkeley Sound, *Darwin*, 362 ! Tyssen Islands, *Cunningham* !

Leaves bright shining green. Flowers clear bright yellow, Dec.–Jan.

Senecio candicans, DC. Prod. vi. 412 (errore *candidans*), non Wall. ; Hook. f. Fl. Ant. ii. 312. *Cacalia candicans*, Vahl, Symb. iii. 91, t. 71.

Hooker, 48 ! West Falklands ; Lake Point, Point North, *Vallentin*, 72 ! Uranie Bay, *Wright* !

Leaves silvery. Flowers yellow. Abundant in Hooker's time, now rare.

Gnaphalium affine, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 610, non D. Don ; Hook. f. Fl. Ant. ii. 310 ; Macloskie, Fl. Patag. viii. 815.

East Falklands ; Port William, *Hooker* ! *Lechler*, 140 !

Gnaphalium antarcticum, Hook. f. Fl. Ant. ii. 310, t. 113, fig. B; Macloskie, Flor. Patag. viii. 815.

Hooker!

Gnaphalium purpureum, Linn. Sp. Pl. ed. I. 854; Hook. f. Fl. Ant. ii. 309; Macloskie, Fl. Patag. viii. 818.

Gaudichaud, D'Urville, Nichol! fairly common, *Vallentin,* 21! Flowers bronze colour.

California and Texas to Chile.

Chiliotrichum amelloideum, Cass. in Dict. Sci. Nat. viii. 577; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 104; Hook. f. Fl. Ant. ii. 304, 577. *C. amelloides,* DC. Prod. v. 216. *C. diffusum,* P. Dusén in Ergebn. Schwed. Exped. Magell. iii. v. 99; Macloskie, Fl. Patag. viii. 798; Birger in Engl. Jahrb. xxxix. (1906) 287!

Edmondston! *Hooker*! *Nichol*! East Falklands, *Lechler,* 141! West Falklands, common on the east coast, *Vallentin,* 52!

Var. **lanceolatum,** DC. Prod. v. 216.

Falkland Islands, *Gaudichaud*!

Patagonia, Fuegia.

The Fâchima plant. The tallest plant in the Falklands except *Veronica elliptica,* Forst. It attains a height of about 5 ft. and forms dense masses of foliage. This plant has a curious aromatic scent, pleasant when one is riding amongst the shrubs, but too pungent when they are gathered and placed in a room.

Erigeron alpinus, Linn., var. **myosotifolius,** Hook. f. Fl. Ant. ii. 306; Macloskie, Fl. Patag. viii. 792.

West Falklands; Roy Cove, common in dry places, *Vallentin,* 2! *Nichol*! Tyssen Islands, *Cunningham*!

Erigeron Vahlii, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 103.

West Falklands, in marshes, *Vallentin,* 52! *Nichol*!

The Marsh Daisy. Flowers brilliant rose, Nov.–Dec.

Baccharis magellanica, Pers. Syn. ii. 425; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100; Hook. f. Fl. Ant. ii. 307. *B. tridentata,* Urv. in Mém. Soc. Linn. Paris, iv. (1826) 610; Gaud. l. c. 103, and in Freyc. Voy. Bot. 135.

Gaudichaud! *Hooker*! *Nichol*! abundant everywhere, *Vallentin,* 53! East Falklands; Berkeley Sound, *Darwin,* 322! 326!

Chile to Hermite Island.

This plant has interesting associations, as it is used by Falkland Islanders instead of holly or mistletoe to decorate churches and houses at Christmas, when its exquisite silvery flowers are just in perfection. It has a creeping habit.

Cotula scariosa, Franch. Miss. Scient. Cap Horn, 345 ; Macloskie, Fl. Patag. viii. 831. *Leptinella scariosa,* Cass. in Bull. Soc. Philomath. 1822, 127 ; Hook. f. Fl. Ant. i. 308.
West Falklands, scarce, *Vallentin,* 24 !
Magellan, Hermite Island, Chile.
Flowers yellow.

Abrotanella emarginata, Cass. Dict. Sci. Nat. xxxvi. 27, and Opusc. Phyt. ii. 42 ; Gaud. in Freyc. Voy. Bot. 465 ; Hook. f. Fl. Ant. i. 24, ii. 308. *Oligosporus emarginatus,* Cass. in Ann. Sci. Nat. 1re sér. v. (1825) 104, t. 3, fig. 4 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 644.
Abundant, *Gaudichaud* ! *Hooker,* 44 !
Magellan, Hermite Island.

Leuceria gossypina, Hook. et Arn. in Comp. Bot. Mag. ii. 43 (*Leuchæria*). *Perdicium suaveolens,* Urv. in Mém. Soc. Linn. Paris, iv. (1826) 611 ; Gaud. in Freyc. Voy. Bot. 135. *Lasiorrhiza ceterachifolia,* Cass. Dict. Sci. Nat. xliii. 80. *L. viscosa,* Cass. l. c. 81. Plante à odeur de Benjoin, Pernetty, Voy. ii. 57.

Abbott, Hooker ! *Lesson* ! East Falklands ; near Stanley, *Lechler* ! *Cunningham* ! Mount William, *Cunningham* ! West Falklands ; Roy Cove, *Vallentin,* 69 !

Magellan.

The "Vanilla Daisy," so called on account of its fragrant scent resembling that of Vanilla.

Perezia recurvata, Less. in Linnæa, v. (1822) 21, and Syn. Comp. 412. *P. Doniana,* Less. Syn. Comp. 412. *Perdicium recurvatum,* Vahl in Skrivt. Nat. Selsk. i. II. (1791) 13, t. 7 ; Gaud. in Ann. Sci. Nat. 1re sér. vi. (1825) 103, and in Freyc. Voy. Bot. 135 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 611, non Don. *Chætanthera recurvata,* Spreng. Syst. iii. 503. *Clarionea recurvata,* D. Don in Trans. Linn. Soc. xvi. (1830) 206. *Homoianthus echinulatus,* Cass. in Dict. Sci. Nat. xxxviii. 458 ; Hook. Ic. Pl. t. 491 ; Hook. f. Fl. Ant. ii. 322. *Homanthis echinulata,* Hombr. et Jacquin. Voy. Pôle Sud, Bot., Dicot. t. 10, fig. S.

Gaudichaud ! *Wright* ! *Abbott* ! *Hooker* ! *Lesson* ! *Edmondston* ! *Sullivan, Vallentin,* 49 (abundant near sea) ! *Nichol* ! East Falklands ; near Stanley, *Cunningham* !

Patagonia, Chile.

Found in a high sunny situation; sweet-scented; locally called "lavender." Leaves very prickly, fragrant, white, lilac and deep blue, Dec.–Jan.

Hypochæris arenaria, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 103, and in Freyc. Voy. Bot. 134, 461; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 609. *H. minima*, Willd. ex Urv. l. c. *Seriola apargioides*, Less. Syn. Comp. 131; Hook. et Arn. in Comp. Bot. Mag. ii. 42. *Achyrophorus arenarius*, DC. Prod. vii. 95; Hook. f. Fl. Ant. ii. 323, t. 112, middle figs. 1–2.

Gaudichaud, *D'Urville*, *Darwin*, *Hooker*!

Hieracium antarcticum, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 608; Gaud. in Freyc. Voy. Bot. 134; Hook. f. Fl. Ant. ii. 324.

Nichol, 5! East Falklands; Port William, *Hooker*, 106! West Falklands, common in rocky places near the sea, *Vallentin*, 5! Fox Bay, *Cunningham* !

Magellan, Port Famine.

Flowers yellow.

Taraxacum officinale, var. **lævigatum**, O. Kuntze, Rev. Gen. Pl. iii. II. 181; Macloskie, Fl. Patag. viii. 901. *T. Dens-Leonis*, Desf., var. *lævigatum*, Hook. f. Fl. Ant. ii. 323, t. 112. *T. lævigatum*, DC. Cat. Hort. Monsp. 149, & Prod. vii. 146; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 604; Gaud. in Freyc. Voy. Bot. 134. *Leontodon Taraxacum*, Linn. Sp. Pl. ed. I. 798. *L. Lycodon*, Banks & Soland. ex Hook. f., l. c.

D'Urville, *Hooker*! *Nichol*! West Falklands, *Vallentin*, 3!

Fuegia.

Macrorhynchus pumilus, DC. Prod. vii. 152; Hook. f. Fl. Ant. ii. 324. *Taraxacum pumilum* and *T. coronopifolium*, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 103, and in Freyc. Voy. Bot. 461; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 609. *M. chilensis*, Hook. et Arn. in Comp. Bot. Mag. ii. 42. *Ixeris monocephala*, Cass. in Dict. Sci. Nat. xxxix. 389. *Leontodon pubescens*, Banks et Soland. ex Hook. f., l. c.

East Falklands, grassy places near the sea, *Darwin*, 535! *Hooker*, 51! *Firmin*, 39! *Nichol*! West Falklands, *Vallentin*, 4!

Magellan.

Flowering at the end of March.

Pratia repens, Gaud. in Freyc. Voy. Bot. 456, t. 79; Hook. f. Fl. Ant. i. 42, ii. 325.

Gaudichaud! *D'Urville*, *Hooker*! *Firmin*, 24! *Nichol*! East Falklands; Berkeley Sound, *Darwin*, 367! near Stanley, *Cunningham*! West Falklands; Roy Cove, in swamps, *Vallentin*, 36!

Fuegia, Chile.
Flowers bright lilac.

Pernettya empetrifolia, Gaud. in Ann. Sci. Nat. 1^re^ sér. i. (1824) 102, and in Freyc. Voy. Bot. 454, t. 67; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 607. *P. pumila*, var. *empetrifolia*, Hook. f. Fl. Ant. ii. 326. *Arbutus empetrifolia,* Linn. f. Suppl. 229. *Andromeda empetrifolia,* Lam. Encycl. i. 155.

East Falklands; Port William, *Hooker*! *Lechler*, 131! *Vallentin*! *Nichol*! West Falklands, *Vallentin*, 28!

Fuegia, Patagonia, Chile.

Gaultheria microphylla, Hook. f. Fl. Ant. ii. 327. *G. antarctica,* Hook. f. l. c. t. 116. *Arbutus microphylla,* Forst. in Comm. Goett. ix. (1789) 32. *A. serpyllifolia,* Lam. Encycl. i. 228. *Pernettya serpyllifolia,* DC. Prod. vii. 587.

Hooker, 82! *Nichol*! East Falklands; Stanley, *Lechler,* 125! *Vallentin*, 29! West Falklands, *Vallentin*!

Magellan, Chile.

The Mountain Berry. Flowers small, white, Nov.–Jan. Berry bright rose-red, edible but rather tasteless.

Primula farinosa, var. **magellanica,** Hook. f. Fl. Ant. ii. 337, t. 120; Pax in Engl. Bot. Jahrb. x. (1888) 200; Pax & Knuth in Engl. Pflanzenr., Prim. 85. *P. magellanica,* Lehm. Monogr. Prim. 62, t. 6. *P. decipiens,* Duby in Mém. Soc. Phys. Genève, x. (1843) 492, t. 2, fig. 1. *P. farinosa,* var. *decipiens,* A. DC. Géogr. Bot. ii. 1049.

East and West Falklands, common, *Hooker*! *Abbott*! *Wright*! *Vallentin*, 27! *Firmin*, 26! *Nichol*! Tyssen Islands, *Cunningham*!

Fuegia, Chile.

About 40 years ago these plants grew to a height of 1½ to 2 ft. with flowers in proportion; but since the introduction of sheep the species has dwindled in size. On a few outlying islands on which there are no sheep the plants still attain their original size. The hillsides are covered with these most fragrant white, or occasionally lavender-coloured, flowers during early summer (November).

Anagallis alternifolia, var. **densifolia,** Hook. f. Fl. Ant. ii. 337. *Lysimachia repens,* Urv. in Mém. Soc. Linn. Paris, iv. (1826) 606; Gaud. in Freyc. Voy. Bot. 133; Hook. Ic. Pl. t. 536.

Along ditches and at the edges of swamps, not common, *D'Urville*, *Wright*! *Hooker*! *Vallentin*, 38! *Firmin*, 5! *Nichol*!

Magellan, Argentine, Chile.

Armeria Macloviana, Cham. in Linnæa, vi. (1831) 567. *Statice cæspitosa*, Poir. Encycl. vii. 396; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 102; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 606. *S. Armeria*, Hook. f. Fl. Ant. ii. 339.

Gaudichaud, *Hooker*! *Firmin*, 38! *Nichol*! West Falklands, seashore, scarce, *Vallentin*, 12!

Magellan, Port Famine.

Flowers bright rose-pink, Nov.–Jan.

Gentiana magellanica, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 89, and in Freyc. Voy. Bot. 134; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 607; Hook. f. Fl. Ant. ii. 328.

Gaudichaud! *D'Urville*, *Wright*! *Hooker*! *Firmin*, 42! East Falklands; Stanley, *Cunningham*! *Vallentin*, 66!

Rare.

Magellan, Fuegia.

Calceolaria Fothergillii, Ait. Hort. Kew. ed. I. i. 30, t. 1; Bot. Mag. t. 348; Hook. f. Fl. Ant. ii. 332, t. 117. *C. Neeana*, Spreng. Syst. Veg. i. 44.

Hooker, 68! *Abbott*! *Firmin*, 29! *Nichol*! West Falklands; Fox Bay, *Cunningham*! sheltered beaches, *Vallentin*, 7!

Very abundant in Hooker's time, now rare. Flowers yellow, spotted with crimson, Dec.–Jan.

Fuegia.

Calceolaria polyrhiza, Cav. Ic. v. 25, t. 441; Hook. f. Fl. Ant. ii. 333.

Falkland Islands, *Née*.

Calceolaria Darwinii, Benth. in DC. Prod. x. 207; Hook. f. Fl. Ant. ii. 333.

West Falklands; Crooked Inlet, Roy Cove, round beach growing near *Aspidium coriaceum*, very rare, *Vallentin*, 6!

Flowers entirely yellow, larger than those of *C. Fothergillii*, Ait.; Dec.

Magellan.

Calceolaria falklandica, Kränzl. in Engl. Pflanzenr., Scroph. Antirr. Calc 42. *Fagelia falklandica*, S. Moore in Journ. Bot. xxviii. (1900) 460.

West Falklands; Roy Cove, very rare, *Nichol*! *Vallentin*, 8!

Limosella aquatica, var. **tenuifolia**, Hook. f. Fl. Ant. ii. 334. *L. tenuifolia*, Nutt. Gen. N. Amer. Pl. ii. 43; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 102, and in Freyc. Voy. Bot. 133; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 607. *L. australis*, R. Br. Prod. 443.

Falkland Islands, bottom of a muddy lake, *Gaudichaud*! *Hooker*!

Veronica serpyllifolia, Linn. Sp. Pl. ed. I. 12 ; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 102, and in Freyc. Voy. Bot. 133 ; Urv. in Mém. Soc. Linn. Paris, vi. (1826) 607 ; Hook. f. Fl. Ant. ii. 334.

East and West Falklands, fairly common, *Vallentin*, 25 ! *Nichol* !

Flowers deep blue.

Veronica elliptica, Forst. f. Prod. 3 ; Hook. f. Fl. Ant. i. 58, ii. 334. *V. decussata*, Ait. Hort. Kew. ed. I. i. 20. *V. marginata*, Colenso in Trans. N. Zeal. Inst. xxviii. (1896) 608.

West Falklands, abundant along creeks, *Vallentin*, 40 ! *Nichol* !

Magellan, Fuegia, New Zealand.

This plant delights to have its roots bathed by the sea-water during spring tides. It is the tallest shrub on the islands, attaining a height of from 5 to 7 feet. Its flowers possess a delightful aroma ; Jan.–Feb.

Plantago monanthos, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 606 ; Gaud. in Freyc. Voy. Bot. 133 ; Barnéoud, Monogr. Plant. 17, excl. syn. ; Hook. f. Fl. Ant. ii. 340, t. 121.

D'Urville, *Hooker* !

Rumex Acetosella, Linn. Sp. Pl. ed. I. 338 ; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 101 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 605 ; Macloskie, Fl. Patag. viii. 348.

Common, but probably introduced, *Gaudichaud* ! *D'Urville*, *Vallentin*, 55 ! *Nichol* !

North temperate and arctic regions ; a variety in Magellan.

Rumex crispus, Linn. Sp. Pl. ed. I. 335 ; Hook. f. Fl. Ant. ii. 341 ; Macloskie, Fl. Patag. viii. 349. *R. Patentia*, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 101 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 605.

East Falklands ; Berkeley Sound, probably introduced, *Hooker* !

North temperate region.

Chenopodium macrospermum, Hook. f. Fl. Ant. ii. 341 ; Macloskie, Fl. Patag. viii. 360.

East Falklands ; Berkeley Sound and St. Salvador Bay, *Darwin* ! *Hooker* !

S. Patagonia.

Empetrum nigrum, var. **rubrum**, A. DC. Prod. xvi. i. 26. *E. rubrum*, Vahl ex Willd. Sp. Pl. iv. 713 ; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 103, and in Freyc. Voy. Bot. 134 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 608 ; Bot. Reg. t. 1783 ; Hook. f. Fl. Ant. ii. 345 ; Macloskie, Fl. Patag. viii. 557 ; Birger in Engl. Jahrb. xxxix. 288, fig. 1.

Wright! *Miers*, 3734! *Edmondston*! *Hooker*! *Darwin*! *Vallentin*, 71! East Falklands, *Cunningham*! *Firmin*, 10!

Magellan, Fuegia, Chile.

Vernacular name in the Falklands "Diddle-dee." This plant covers miles of country as heather does on English moorlands. The dried twigs make excellent fuel. The fruit, which is bitter and not unlike a cranberry, is considered to have tonic properties.

Nanodea muscosa, Gærtn. Fruct. iii. 251, t. 225; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 101, t. 2, fig. 3, and in Freyc. Voy. Bot. 442; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 605; Macloskie, Fl. Patag. viii. 339. *Balexerda muscosa*, Commers. ex Hook. f., l. c.

Very common, *Gaudichaud*! *Hooker*!

Magellan, Fuegia, Port Famine, Hermite Island.

Drapetes muscosa, Lam. in Journ. d'Hist. Nat. i. (1792) 186, t. 10, fig. 1; Gærtn. Fruct. iii. 199, t. 215; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 605; Hook. f. Fl. Ant. ii. 343.

D'Urville, *Hooker*!

Pogonia tetraphylla, Poepp. et Endl. Nov. Gen. et Sp. Pl. ii. 16, t. 122. *Codonorchis Lessonii*, Lindl. Gen. et Sp. Orch. 411; Hook. f. Fl. Ant. ii. 351, t. 125; Macloskie, Fl. Patag. viii. 324. *C. Poeppigii*, Lindl. l. c. *Calopogon Lessonii*, Brongn. in Duperrey, Voy. Bot. 188, t. 37, fig. 1. *Epipactis Lessonii*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 605.

Very local, *Hooker*! *Vallentin*, 28! *Firmin*, 9! *Nichol*!

Magellan, Chile, Chiloe.

The leaves vary from 2 to 4, 3 being the usual number. This plant springs from a small tuber, and while one season it is very plentiful, not a single plant is to be found the next. The scented flowers, which appear in November and December, are white, spotted irregularly with purple, and vary considerably in size.

Chloræa falklandica, Kränzl. in Engl. Jahrb. xliv. (1910), Beibl. no. 101, 5.

East Falklands; Port William, Sparrow Cove, *Skottsberg*, 34, between Mount Darwin and Mount Pleasant, *Joley*.

Chloræa Gaudichaudii, Brongn. in Duperrey, Voy. Bot. 189, t. 44, fig. A; Hook. f. Fl. Ant. ii. 350; Macloskie, Fl. Patag. viii. 322. *Arethusa lutea*, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 101, and in Freyc. Voy. Bot. t. 133; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 604.—*Satyrion*, Pernetty, Voy. ii. 54, t. 8, fig. 5.

Gaudichaud! *Wright*! *Hooker*! *Nichol*! West Falklands; Roy Cove, in moist places, rare, *Vallentin*, 54!

Leaves spotted. Flowers yellowish-green, Dec.–Jan.

Asarca Commersonii, Hook. f. Fl. Ant. ii. 351; Kränzl. Orch. Gen. et Sp. ii. I. 44, t. 2, fig. E. *Chloræa Commersonii,* Brongn. in Duperrey, Voy. Bot. 189; Macloskie, Fl. Patag. viii. 322.

Wright! *Chartres*! *Abbott*! *Firmin,* 1!

Magellan, Fuegia.

Asarca odoratissima, Poepp. et Endl. Nov. Gen. et Sp. Pl. ii. 13, t. 118; Kränzl. Orch. Gen. et Sp. ii. I. 29, t. 3, fig. L. *Chloræa odoratissima,* Macloskie, Fl. Patag. viii. 323.

Wright!

Chile, Patagonia.

Sisyrinchium filifolium, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 101, and in Freyc. Voy. Bot. 133; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 604; Hook. f. Fl. Ant. ii. 352, t. 126; Bot. Mag. t. 829; Macloskie, Fl. Patag. viii. 315.

Abbott! *Vallentin,* 70! *Firmin,* 16! 43! *Nichol*! East Falklands; Port William, *Hooker,* 98! Stanley, *Cunningham*! *Lechler*!

Magellan.

Vernacular name "Pale Maiden." From November to January the hill-sides are white with this beautiful flower, which is very fragrant.

Luzuriaga marginata, Benth. et Hook. f. Gen. Pl. iii. 768. *Enardea marginata,* Banks et Soland. ex Gærtn. Fruct. i. 283, t. 59, fig. 3. *Callixene marginata,* Lam. Ill. t. 248; Encycl. Suppl. i. 36; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 101, t. 2, fig. 2, and in Freyc. Voy. Bot. 133; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 604; Hook. f. Fl. Ant. ii. 354; Macloskie, Fl. Patag. viii. 308.

Gaudichaud! *Darwin,* 531! *Cunningham*! *Abbott*! *Hooker,* 22! *Firmin,* 11! *Nichol,* 44! Baie Française, *Lesson*!

Magellan, Fuegia, Patagonia.

Common, especially amongst stones. Flowers white, sweet-scented, Nov.–Dec. Berry purple, poisonous.

Astelia pumila, R. Br. Prod. 291; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 101, and in Freyc. Voy. Bot. 132; Urv. in Mém. Soc. Linn. Paris, iv. (1876) 603; Hook. f. Fl. Ant. i. 76, ii. 357, t. 127. *Melanthium pumilum,* Forst. Comm. Goett. ix. (1789) 30, t. 6. *Funckia magellanica,* Willd. in Mag. Naturf. Fr. ii. (1808) 19.

Gaudichaud! *Hooker,* 102! East Falklands; Stanley, *Cunningham*! West Falklands; Roy Cove, in peat swamps, *Vallentin,* 30!

Patagonia, South Chile.

Flowers inconspicuous, pale green.

Rostkovia grandiflora, Hook. f. Fl. Ant. i. 82, ii. 357. *Juncus grandiflorus*, Linn. f. Suppl. 209; Forst. Comm. Goett. ix. (1789) 27, t. 3; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100, and in Freyc. Voy. Bot. 132; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 603. *Marsippospermum calyculatum*, Desv. Journ. Bot. i. (1808) 330. *M. grandiflorum*, Hook. Ic. Pl. t. 533.

Wright! *Firmin*, 19! East Falklands; Stanley, *Cunningham*! West Falklands; Mount Cook, Roy Cove, *Vallentin*, 62!

Patagonia.

Juncus pallidus, R. Br. Prod. 258. *J. vaginatus*, R. Br. l. c.

West Falklands, *Vallentin*, 66!

Australia, New Zealand.

This plant has only been found once and that in a place close to Roy Cove settlement where machinery had been unpacked, which leads me to believe that seed had been introduced in the packing.

Juncus scheuchzerioides, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100; Hook. f. Fl. Ant. ii. 358; var. *inconspicuus*, Macloskie, Fl. Patag. viii. 301. *J. inconspicuus*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 603.

East and West Falklands, fairly common, *Gaudichaud*! *Hooker*! *Firmin*, 18! *Vallentin*, 46! *Nichol*! Tyssen Islands, *Cunningham*!

Magellan, Patagonia.

Luzula Alopecurus, Desv. Journ. Bot. i. (1808) 159; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100; Hook. f. Fl. Ant. ii. 359. *Juncoides Alopecurus*, Macloskie, Fl. Patag. viii. 301.

Gaudichaud! *Wright*! *Nichol*! East Falklands; Mount William, *Cunningham*! Berkeley Sound, *Darwin*, 293! Baie Française, *Lesson*! West Falklands; Roy Cove, common near beaches, *Vallentin*, 63!

Magellan.

Tetroncium magellanicum, Willd. in Mag. Naturf. Fr. ii. (1808) 17; Hook. Ic. Pl. t. 534; Hook. f. Fl. Ant. ii. 359, t. 128; Macloskie, Fl. Patag. viii. 151. *Triglochin reflexum*, Vahl ex Hook. f. l. c. *T. magellanicum*, Vahl ex Hook. f. l. c. *Cathanthes*, Rich. in Mém. Mus. Par. i. (1815) 365.

Wright!

Magellan.

Gaimardia australis, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100, and in Freyc. Voy. Bot. 419, t. 3; Macloskie, Fl. Patag. 293.

D'Urville, *Gaudichaud*! *Hooker*, 8!

Fuegia, Hermite Island.

Oreobolus obtusangulus, Gaud. in Ann. Sci. Nat 1re sér. v. (1825) 99, t. 2, fig. 1, and in Freyc. Voy. Bot. 417; Hook. f. Fl. Ant. ii. 360.
D'Urville, Gaudichaud! *Hooker*!
Cape Horn.

Heleocharis macrorrhiza, Boeck. in Flora, lxxi. (1858) 413. *Scirpus melanostachys,* Urv. in Mém. Soc. Linn. Paris, iv. (1826) 600. *Fimbristylis melanostachys,* Brongn. in Duperrey, Voy. Bot. ii. 181. *Eleocharis palustris,* Hook. f. Fl. Ant. ii. 360.
East and West Falklands, *D'Urville, Hooker,* 100! *Wright*! *Abbott*! *Vallentin,* 42! *Nichol*!

Isolepis pygmæa, var. **brevis,** Hook. f. Fl. Ant. ii. 361. *I. brevis,* Brongn. in Duperrey, Voy. Bot. 180. *I. magellanica,* Gaud. in Freyc. Voy. Bot. 414. *I. meyeniana,* Nees in Nov. Act. Acad. Cæs. xix. (1843), Suppl. 87.
D'Urville, Hooker!

Scirpus cernuus, Vahl, Enum. ii. 245.
East and West Falklands, common, *Hooker,* 101! *Vallentin,* 41! *Nichol*!
Cosmopolitan.

Uncinia Macloviana, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 99, and in Freyc. Voy. Bot. 412; Hook. f. Fl. Ant. ii. 370; Macloskie, Fl. Patag. viii. 270.
Gaudichaud!

Carex acaulis, D'Urv. in Mém. Soc. Linn. Paris, iv. (1826) 599; Brongn. in Duperrey, Voy. Bot. 153, t. 28, fig. A; Hook. f. Fl. Ant. ii. 363; Macloskie, Fl. Patag. viii. 277.
D'Urville.

Carex bonariensis, Desf. in Poir. Encycl. Suppl. iii. 250; Macloskie, Fl. Patag. viii. 279.
Falkland Islands, ex *Macloskie.*
Argentine.

Carex canescens, var. **alpicola,** Wahlenb. ex Reichenb. Fl. Germ. Excurs. 58 (1830); Macloskie, Fl. Patag. viii. 279. *C. canescens,* var. *β,* Wahlenb. in Vet.-Akad. Handl. Stockholm, xxiv. (1803) 147.
Falkland Islands, ex *Macloskie.*
Magellan, Fuegia, Europe, Greenland, Alaska.

Carex curta, Good. in Trans. Linn. Soc. ii. (1794) 145 ; Hook. f. Fl. Ant. ii. 363. *C. spicata,* Banks & Soland. ex Hook. f. l. c. *C. similis,* Urv. in Mém. Soc. Linn. Paris, iv. (1826) 599.

D'Urville.

Carex decidua, Boott ex Hook. f. Fl. Ant. ii. 363. *C. cæspitosa,* Banks & Soland. ex Hook. f. l. c.

Hooker !

Fuegia, Good Success Bay.

Carex filiformis, Linn. Sp. Pl. ed. I. 976. *C. æmathorrhyncha,* Desv. in C. Gay, Fl. Chil. vi. 224.

Abbott ! West Falklands; Roy Cove, moist places, fairly common, *Vallentin,* 43 !

Europe, N. Asia, N. & S. America.

Carex indecora, var. **humilis,** Boott in Hook. f. Fl. Ant. ii. 367. *C. fuscula,* Urv. in Mém. Soc. Linn. Paris, iv. (1826) 599; Brongn. in Duperrey, Voy. Bot. 154, t. 28, fig. B ; Macloskie, Fl. Patag. viii. 282.

D'Urville, Hooker !

Carex leporina, Linn. Sp. Pl. ed. I. 973 ; Macloskie, Fl. Patag. viii. 284. *C. Macloviana,* Urv. in Mém. Soc. Linn. Paris, iv. (1826) 599.

Falkland Islands, ex *Macloskie.*

Carex similis, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 599 ; Macloskie, Fl. Patag. viii. 287.

Falkland Islands, ex *Macloskie.*

Fuegia.

Carex trifida, Cav. Ic. v. 41, t. 465 ; Macloskie, Fl. Patag. viii. 285.

Falkland Islands, ex *Macloskie.*

Magellan, Fuegia, New Zealand.

Hierochloe redolens, R. Br. Prod. 209. *H. antarctica,* R. Br. l. c. *H. magellanica,* Hook. f. Fl. Ant. ii. 375.

Hooker ! *Wright* ! *Firmin,* 21 ! *Nichol* ! Baie Française, *Lesson* ! West Falklands ; Roy Cove, very local, *Vallentin,* 77 !

S. temperate region.

Cinnamon Grass. Found chiefly near running water. Very fragrant, not unlike cinnamon. Abundant in Hooker's time, now rare.

Alopecurus alpinus, Sm. Fl. Brit. iii. 1936 ; Macloskie, Fl. Patag. viii. 179.
Falkland Islands, ex *Macloskie.*
Magellan, Fuegia.
Chile, N. temperate and arctic regions.

Agrostis alba, Linn. Sp. Pl. ed. I. 63; Hook. f. Fl. Ant. ii. 372 ; Macloskie, Fl. Patag. viii. 184. *A. cæspitosa*, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100, and in Freyc. Voy. Bot. 131.
Gaudichaud! *Wright*!

Var. **stolonifera**, Hook. f. l. c. *A. stolonifera*, Linn. Sp. Pl. ed. I. 62.
Hooker, 12!
Chiloe, Europe, Asia.

Agrostis antarctica, Hook. f. Fl. Ant. ii. 374, t. 132 ; Macloskie, Fl. Patag. viii. 185.
Hooker, 2! *Wright*!
Magellan, Fuegia, S. Chile, Kerguelen Island.

Agrostis canina, Linn. Sp. Pl. ed. I. 62. *A. canina*, var. *falklandica*, Macloskie, Fl. Patag. viii. 186. *A. falklandica*, Hook. f. Fl. Ant. ii. 373.
In marshy places, on rocks near the sea and on hills, abundant, *Hooker*!
W. Patagonia, widely spread in both hemispheres.

Agrostis magellanica, Lam. Ill. i. 160; Macloskie, Fl. Patag. viii. 188.
Falkland Islands, ex *Macloskie.*
S. Fuegia, S. Chile, Kerguelen Island.

Agrostis prostrata, Hook. f. Fl. Ant. ii. 373; Macloskie, Fl. Patag. viii. 190.
East Falklands; boggy ground on Hog Island, Berkeley Sound, rare, *Hooker*, 13!

Eriachne malouinensis, Steud. Syn. Pl. Gram. 236; Macloskie, Fl. Patag. viii. 197.
Falkland Islands, ex *Macloskie.*
Magellan.

Aira caryophyllea, Linn. Sp. Pl. ed. I. 66; Hook. f. Fl. Ant. ii. 375 ; Macloskie, Fl. Patag. viii. 198.
Falkland Islands, introduced, *Wright*! *Hooker*!
Europe, Orient.

Deschampsia antarctica, Macloskie, Fl. Patag. viii. 200. *Aira antarctica,* Hook. Ic. Pl. t. 150; Hook. f. Fl. Ant. ii. 377, t. 133. *Airidium elegantulum,* Steud. Syn. Pl. Gram. 423.
Hooker !
Hermite Island, Kerguelen Island, New S. Shetlands.

Deschampsia flexuosa, Trin. in Bull. Acad. Pétersb. i. (1836) 66; Macloskie, Fl. Patag. viii. 201. *Aira flexuosa,* Linn. Sp. Pl. ed. I. 65; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100, and in Freyc. Voy. Bot. 100; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 600; Hook. f. Fl. Ant. ii. 375.
Gaudichaud ! *Firmin,* 28 !
Magellan, Rio Janeiro, N. temperate region.

Deschampsia Martini, Phil. in Ann. Univ. Chil. xciv. (1896) 24; Macloskie, Fl. Patag. viii. 202.
Falkland Islands, ex *Macloskie.*
Chile.

Trisetum subspicatum, Beauv. Agrost. 88; Hook. f. Fl. Ant. i. 97, ii. 377. *T. andinum,* Benth. Pl. Hartweg. 261. *T. spicatum,* Richter, Pl. Europ. i. 59; Macloskie, Fl. Patag. viii. 205.
D'Urville, Hooker.
Magellan, Port Famine, Hermite Island, Eurasia.

Triodia antarctica, Hook. f. Fl. Ant. ii. 380, non Benth. nec Petrie. *Sieglingia antarctica,* O. Kuntze, Rev. Gen. Pl. i. 737; Macloskie, Fl. Patag. viii. 214.
Falkland Islands.
Magellan, Fuegia, Hermite Island.

Arundo pilosa, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 600; Hook. f. Fl. Ant. ii. 375. *Ampelodesmos australis,* Brongn. in Duperrey, Voy. Bot. 31, t. 6.
D'Urville, Hooker ! *Wright* ! *Sullivan* !

Poa controversa, Steud. Syn. Pl. Gram. 260; Macloskie, Fl. Patag. viii. 226.
Falkland Islands, ex *Macloskie.*
Fuegia, Patagonia.

Poa flabellata, Hook. f. in Phil. Trans. clxviii. (1877) 22 in obs.; Macloskie, Fl. Patag. viii. 227. *Poa cæspitosa*, Birger in Engl. Jahrb. xxxix. (1906) 293, t. 2. *Dactylis cæspitosa*, Forst. Comm. Goett. ix. (1789) 22; Hook. f. in Lond. Journ. Bot. ii. (1843) 298, tt. 9–10, and Fl. Ant. ii. 384, tt. 136–7. *Festuca cæspitosa*, Roem. et Schult. Syst. Veg. ii. 732. *F. flabellata*, Lam. Encycl. ii. 462; Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100, and in Freyc. Voy. Bot. 409; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 603; Brongn. in Duperrey, Voy. Bot. 36. "*Glayeux*," Pernetty, Voy. i. 343.

Gaudichaud ! *Abbott* ! *Hooker*, 104 ! *Morony*, 1341 ! *Vallentin*, 57 !

Magellan, Fuegia, Staten Land, Hermite Island, S. Georgia.

Tussac Grass. Very abundant throughout the islands in Hooker's time, now confined to small islets and enclosed areas. Cattle are very fond of its edible roots, hence its rapid extinction.

Poa pratensis, Linn. Sp. Pl. ed. I. 67; Hook. f. Fl. Ant. ii. 379; Macloskie, Fl. Patag. viii. 229. *P. compressa*, var. *virescens*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 600. *P. alpina*, Brongn. in Duperrey, Voy. Bot. 44, non Linn.

Falkland Islands, ex *Macloskie*.

Magellan, Port Famine, Good Success Bay, North temperate region.

Festuca antarctica, Kunth, Rév. Gram. i. 132, non Spreng.; Hook. f. Fl. Ant. ii. 382; Macloskie, Fl. Patag. viii. 233. *Arundo antarctica*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 602.

East Falklands; Port William, very scarce, *Hooker* ! West Falklands; Roy Cove, fairly common, *Vallentin*, 75 !

Patagonia ?

Festuca arenaria, Lam. Encycl. i. 191; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 602; Brongn. in Duperrey, Voy. Bot. 35; Hook. f. Fl. Ant. ii. 382.

Falkland Islands, *Commerson* ! *Gaudichaud* ! Baie Française, *Lesson* !

Magellan, Port Famine.

Festuca Arundo, Hook. f. Fl. Ant. ii. 381. *F. Alopecurus*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 664; Brongn. in Duperrey, Voy. Bot. 32. *Poa Alopecurus*, Kunth, Enum. Pl. i. 256. *Arundo Alopecurus*, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 100, and in Freyc. Voy. Bot. 409.

Abundant, *D'Urville*, *Hooker* !

Festuca bromoides, Linn. Sp. Pl. ed. I. 75 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 601 ; Hook. f. Fl. Ant. ii. 384 ; Macloskie, Fl. Patag. viii. 234.
Falkland Islands, introduced, *D'Urville, Hooker* !
N. temperate region.

Festuca erecta, D'Urv. in Mém. Soc. Linn. Paris, iv. (1826) 601, non Wallr. ; Brongn. in Duperrey, Voy. Bot. 37, t. 7 ; Hook. f. Fl. Ant. ii. 384.
D'Urville, Hooker !
Fuegia, Hermite Island, Kerguelen Island.

Festuca magellanica, Lam. Encycl. ii. 461 ; Ill. i. 189. *F. ovina*, var. *magellanica*, Hack. ex Macloskie, Fl. Patag. viii. 238.
East and West Falklands, rocks near sea, *Vallentin*, 60 ! *Nichol* !
Magellan.

Lolium perenne, Linn. Sp. Pl. ed. I. 83 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 601 ; Brongn. in Duperrey, Voy. Bot. 57 ; Hook. f. Fl. Ant. ii. 389 ; Macloskie, Fl. Patag. viii. 244.
Frequent on sandy sea-shores, *D'Urville.*
Europe, temperate Asia.

Agropyron magellanicum, Hack. ex P. Dusén in Ergebn. Schwed. Exped. Magellan, iii. v. 331 ; Macloskie, Fl. Patag. viii. 246. *Triticum repens*, var. *pungens*, Brongn. in Duperrey, Voy. Bot. 57 ; Hook. f. Fl. Ant. ii. 389. *T. glaucum*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 601
D'Urville.
Magellan.

Agropyron repens, Beauv. Agrost. 102. *Triticum repens*, Linn. Sp. Pl. ed. I. 86 ; Hook. f. Fl. Ant. ii. 389.
Wright ! *Chartres* ! East Falklands ; Port William, *Hooker*, 9 ! West Falklands ; Roy Cove Creek, *Vallentin*, 76 !
Temperate regions.
Blue Grass. Abundant in Hooker's time, now rapidly becoming extinct.

Trichomanes cæspitosum, Hook. Sp. Fil. i. 132, t. 40, fig. B. *Hymenophyllum cæspitosum*, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 908, and in Freyc. Voy. Bot. 374, t. 5, fig. 2 ; Urv. in Mém. Soc. Linn. Paris, iv. (1826) 597.
Falkland Islands, on trunks of shrubs, *Gaudichaud* ! *D'Urville, Hooker* !
Hermite Island, Staten Land, Fuegia.

Trichomanes sibthorpioides, Bory ex Willd. Sp. Pl. v. 498 ; C. Christens. Ind. 649. *T. flabellatum*, Bory in Duperrey, Voy. Bot. 281 ; Hook. f. Fl. Ant. ii. 391 ; Hook. & Bak. Syn. Fil. ed. 2, 76. *T. flabellula*, Urv. in Mém. Soc. Linn. Paris, iv. (1826) 597.

Falkland Islands, *Gaudichaud*, *D'Urville*.

Bourbon.

Not seen by Hooker or Vallentin.

Hymenophyllum peltatum, Desv. Prod. 333 ; C. Christens. Ind. 365. *H. Wilsoni*, var. γ, Hook. Sp. Fil. i. 96 ; Hook. f. Fl. Ant. ii. 390.

Falkland Islands, quartz rocks on hills, *Hooker* !

Hermite Island, Fuegia, Temperate S. America, Tasmania, New Zealand, Atlantic Islands, S. Africa, W. & S. Europe.

Cystopteris fragilis, Bernh. Neu. Journ. Bot. ii. 27 ; Hook. & Bak. Syn. Fil. ed. 2, 103. *Polypodium fragile*, Linn. Sp. Pl. ed. II. 1091. *Filix fragilis*, Underw., Our Native Ferns, ed. 6, 119 (1900).

West ? Falklands, *Sullivan* ! *Nichol*, 56 !

Magellan, Cosmopolitan.

Dryopteris Filix-mas, var. **elongata**, C. Christens. Ind. 264. *Nephrodium Filix-mas*, var. *elongatum*, Hook. Sp. Fil. iv. 117. *Polypodium elongatum*, Ait. Hort. Kew. ed. I. iii. 465.

Falkland Islands, *Vallentin* !

Cosmopolitan in temperate regions.

Dryopteris spinulosa, var. **dilatata**, C. Christens. Ind. 264. *Nephrodium spinulosum*, var. *dilatatum*, Hook. Brit. Ferns, t. 19 ; Sp. Fil. iv. 127.

Falkland Islands, *Vallentin* !

Cosmopolitan in temperate regions.

Polystichum adiantiforme, J. Sm. Hist. Fil. 220 ; C. Christens. Ind. 578. *Polypodium adiantiforme*, Forst. Prod. 82. *Aspidium coriaceum*, Sw. in Schrad. Journ. (1800) 40. *A. capense*, Willd. Sp. Pl. v. 267.

Nichol ! West Falklands : Crooked Inlet, Roy Cove, in a long sheltered creek where it grows in great profusion, *Vallentin*, 109 A !

Throughout S. America, West Indies, Gough Island, South Africa, Mascarene Islands.

Fronds a brilliant glossy green.

Polystichum mohrioides, Presl, Tent. 83 ; C. Christens. Ind. 584. *Aspidium mohrioides*, Bory in Mém. Soc. Linn. Paris, iv. (1826) 597, and in Duperrey, Voy. Bot., Crypt. 267, t. 35, fig. 1 ; Hook. f. Fl. Ant. ii. 392, t. 149.

Falkland Islands, *Lesson*! *Hooker*, 117! *Abbott*! *D'Urville*! East Falklands: Mount William, *Cunningham*! West Falklands: Roy Cove, under rocks near the sea, rare, *Vallentin*, 79!

Amsterdam Is., Marion Is., Patagonia, Chile.

Asplenium magellanicum, Kaulf. Enum. Fil. 175; Hook. et Grev. Ic. Fil. t. 180; Hook. f. Fl. Ant. ii. 392; Hook. & Bak. Syn. Fil. ed. 2, 213.

West Falklands: Port Edgar, *Vallentin*!

Hermite Is., Fuegia, Patagonia, Chile.

Blechnum Penna-marina, Kuhn, Fil. Afr. 92; C. Christens. Ind. 158. *Polypodium Penna-marina*, Poir. Encycl. v. 520. *Lomaria alpina*, Spreng. Syst. iv. 62; Hook. Fil. Exot. t. 32; Hook. & Bak. Syn. Fil. ed. 2, 179. *L. polypodioides*, Gaud. in Ann. Sci. Nat. v. (1828) 908, and in Freyc. Voy. Bot. 374. *L. blechnoides*, Bory in Duperrey, Voy. Bot., Crypt. 273. *L. antarctica*, Carmich. in Trans. Linn. Soc. xii. (1819) 512. *L. linearis*, Colenso in Tasman. Phil. Journ. i. (1841) 376, ii. (1844) 176. *Stegania alpina*, *β. latiuscula*, Bory ex Urv. in Mém. Soc. Linn. Paris, iv. (1826) 597.

Falkland Islands, *Hooker*, 17! common throughout the archipelago, *Vallentin*, 59! West Falklands, *Cunningham*! Port William, *Lechler*, 84.

Tristan d'Acunha, Magellan, St. Paul, Marion, Kerguelen and Gough Islands, S. Brazil, New Zealand.

This species often covers the ground for many yards; its fronds come up ruddy in the spring, and gradually change to a dark glossy green.

Blechnum tabulare, Kuhn, Fil. Afr. 94; C. Christens. Ind. 160. *Lomaria Boryana*, Willd. Sp. Pl. v. 292; Hook. & Bak. Syn. Fil. ed. 2, 180. *L. magellanica*, Desv. Berl. Mag. v. (1811) 330; Hook. f. Fl. Ant. ii. 393; var. *angustisecta*, Bory in Mém. Soc. Linn. Paris, iv. (1826) 597. *L. setigera*, Gaud. in Ann. Sci. Nat. 1re sér. v. (1825) 98, and in Freyc. Voy. Bot. 130. *L. robusta*, Carmich. in Trans. Linn. Soc. xii. (1828) 512. *L. zamioides*, Gard. ex Hook. f. Fl. Ant. ii. 393. *Pteris palmæformis*, Thouars, Fl. Tristan d'Acunha, 30. "*Ceterach*," Pernetty, Voy. ii. 56.

Falkland Islands, abundant, *Wright*! *Vallentin*! *Nichol*! East Falklands, *Cunningham*! Berkeley Sound, *Darwin*, 403! West Falklands; Roy Cove, *Vallentin*, 58!

Temperate and tropical S. America, West Indies, South Africa.

The young fronds come up bright red, colouring the hill-sides where they grow. An abnormal form with the pinnæ acuminate at the apex and much narrowed throughout the lower half has been found only once at Roy Cove by Mrs. Vallentin (no. 60).

Gleichenia cryptocarpa, Hook. Sp. Fil. i. 7, t. 6, fig. A; Hooker & Baker, Syn. Fil. ed. 2, 13. *Mertensia cryptocarpa*, Gay, Fl. Chil. vi. 539.

West Falklands, *Chartres*! *Robinson*! Whale Bay, Roy Cove, rare, *Vallentin*, 15!

Chile, Magellan.

Lycopodium clavatum, var. **magellanicum**, Hook. f. Fl. Ant. ii. 394; Fl. Nov. Zeal. ii. 54; Baker, Handb. Fern Allies, 26.

Falkland Islands, *Hooker*.

Magellan, Fuegia, Kerguelen Is.

The type occurs in the arctic and alpine zones of both hemispheres, and on mountains within the tropics.

ENUMERATION OF CHINESE FERNS.

By Fleet-Surgeon CHARLES GEEKIE MATTHEW,
M.B., R.N. (retired), F.L.S.

[Read 2nd February, 1911.]

THE system of nomenclature and conception of genera used in this Enumeration are those of Diels, as accepted by Christensen in his 'Index Filicum.'

Cross-references are given in many cases where the identity of old and well-known species is veiled under newer and less familiar names.

Nephrodium, Richard, has been retained for the reception of a few species which have recently been described under that generic heading or have escaped re-naming into *Dryopteris* by Christensen.

The references given do not necessarily apply to the original descriptions of the species, but to records of their occurrence within the Chinese area.

ACROPHORUS STIPELLATUS, Moore; Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 4. *Davallia stipellata*, Wall.—Formosa.

ACROSTICHUM AUREUM, Linn.; Benth., Fl. Hongk. (1861) 443.—Hongkong: Kwangtung: Formosa.

ADIANTUM ACROCARPON, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 110.—Kweichau.

BALANSÆ, Bak. in Journ. Bot. xxviii. (1890) 263.—Yunnan: Szechuen: Hupeh.

ADIANTUM CAPILLUS-JUNONIS, Rupr. ; Diels in Engl. Jahrb. xxix. (1900) 200.—China, West and South : Formosa.

CAPILLUS-VENERIS, Linn. ; Diels, *l. c.* 202.—Hongkong : China, West and South : Shensi : Formosa.

Var. OBTUSUM, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 224.—Kweichau.

Var. SINUATUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 61.—Szechuen.

Var. TRIFIDUM, Willd. ; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 224.—Kweichau : Hupeh.

CAUDATUM, Linn. ; Benth., Fl. Hongk. (1861) 447.—China, West and South : Formosa.

DAVIDI, Franch. ; Bak. in Ann. Bot. v. (1891) 209.—Yunnan : Szechuen.

DELAVAYI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 63.—Yunnan.

DIAPHANUM, Blume ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 617.—Formosa.

EDENTULUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 63.—Yunnan.

EDGEWORTHII, Hook. ; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 136.—Kweichau : Szechuen.

ERYTHROCHLAMYS, Diels in Engl. Jahrb. xxix. (1900) 201.—China, South.

FABERI, Bak. in Journ. Bot. xxvi. (1888) 225.—Szechuen.

FIMBRIATUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 62.—Yunnan.

FLABELLULATUM, Linn. ; Benth., Fl. Hongk. (1861) 447.—Hongkong : Kwangtung : Szechuen : Fokien : Formosa : Loochoo.

GRAVESII, Hance in Journ. Bot. xiii. (1875) 197. *Adiantum Mariesii*, Bak.—Kwangtung : Hupeh.

HISPIDULUM, Sw. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 617.—Formosa.

LEVEILLEI, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 12.—Kweichau.

LUNULATUM, Burm. ; Benth., Fl. Hongk. (1861) 446.—China, South : Formosa.

Var. LIMBATUM, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 226.—Kweichau : Yunnan : Szechuen.

Var. SUBJUNONICUM, Christ in Lécomte, Not. Syst. i. (1909) 17.—Yunnan.

Mariesii, *Bak.* = A. Gravesii, *Hance.*

MICHELII, Christ in Bull. Acad. Géogr Bot. xix. (1910) 12.—Kweichau.

ADIANTUM MONOCHLAMYS, Eat.; Diels in Engl. Jahrb. xxix. (1900) 201.—China, North: Korea.

Var. LATEDELTOIDEA, Christ in Nuov. Giorn. Bot. Ital. iv. (1907) 88.—Shensi.

Var. PLURISORUM, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 4.—Korea.

PEDATUM, Linn.; Diels in Engl. Jahrb. xxix. (1900) 200.—China, South and West: Shensi: Manchuria: Korea.

Var. GLAUCINIUM, Christ in Bull. Herb. Boiss. vi. (1898) 957.—Yunnan.

Var. MYRIOSORUM, Christ, *l. c.* iii. (1903) 510. *A. myriosorum*, Bak.—Hupeh: Yunnan.

Var. PROTRUSUM, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 110.—Kweichau.

PRATTII, Bak. in Journ. Linn. Soc., Bot. xxix. (1892) 321.—China, West.

REFRACTUM, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 224.—Kweichau: Szechuen.

ROBOROWSKII, Maxim. in Mél. Biol. xi. (1883) 867.—Yunnan: Kansu.

Var. ROBUSTUM, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 137.—Szechuen.

SUBEMARGINATUM, Christ in Bull. Herb. Boiss. iii. (1903) 511.—Hupeh.

VENUSTUM, D. Don; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 136.—Yunnan: Szechuen.

ALLANTODEA CAVALERIANA, Christ, *l. c.* xiii. (1904) 149.—Kweichau.

ALSOPHILA CONFUCII, Christ, *l. c.* xvi. (1906) 103.—Szechuen.

contaminans, *Wall.* = A. glauca, *J. Sm.*

COSTULARIS, Bak. in Kew Bull. 1906, 8.—Yunnan.

DENTICULATA, Bak. in Journ. Bot. xxiii. (1885) 102.—Kwangtung: Formosa.

FAUREI, Christ in Bull. Herb. Boiss. sér. 2, i. (1901) 1019.—Loochoo.

FORMOSANA, Bak. in Ann. Bot. v. (1891) 190.—Formosa.

GLABRA, Hook., var. CAVALERIANA, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 141.—Kweichau.

GLAUCA, J. Sm. *A. contaminans*, Wall.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 571.—Formosa.

HENRYI, Bak. in Kew Bull. 1898, 229.—Yunnan.

LATEBROSA, Wall.; Christ in Bull. Herb. Boiss. vii. (1899) 18.—Yunnan: Formosa.

PODOPHYLLA, Hook.; Benth., Fl. Hongk. (1861) 460.—Hongkong: China, South: Formosa: Loochoo.

PUSTULOSA, Christ in Bull. Herb. Boiss. sér. 2, ii. (1901) 1019.—Loochoo.

RHEOSORA, Bak.; Christ, *l. c.* vi. (1898) 972.—Yunnan.

SUBGLANDULOSA, Hance in Ann. Sc. Nat. sér. V. v. (1866) 253.—Formosa.

ALSOPHILA TOMENTOSA, Hook.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 572.—Formosa.

ANGIOPTERIS CRASSIPES, Wall.; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 270.—Kweichau: Szechuen: Loochoo.

EVECTA, Hoffm.; Benth., Fl. Hongk. (1861) 440. *Polypodium evectum*, Forst.—Hongkong: China, South: Fokien: Formosa: Loochoo.

Var. ALATA, Christ in Bull. Herb. Boiss. vi. (1898) 973.—Yunnan.

ANOGRAMMA MAKINOI, Christ. *Gymnogramme Makinoi*, Maxim.; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 129.—Szechuen: Shensi: Quelpart I.

MICROPHYLLA, Diels. *Gymnogramme microphylla*, Hook.; Christ, *l. c.* xiii. (1904) 110.—Kweichau.

ANTROPHYUM GREVILLEI, Balf. *A. Cumingii*, Fée; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 626.—Formosa.

LATIFOLIUM, Blume; C. Chr., Ind. Fil. (1905) 60.—Yunnan.

PETIOLATUM, Bak. in Kew Bull. 1906, 14.—Yunnan: Kweichau.

PLANTAGINEUM, Kaulf.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 626. *Hemionitis plantaginea*, Cav.—Formosa.

RETICULATUM, Kaulf.; Christ in Bull. Herb. Boiss. vii. (1899) 3. *Hemionitis reticulata*, Forst.—Yunnan: Formosa.

STENOPHYLLUM, Bak. in Kew Bull. 1898, 233.—Yunnan.

ARCHANGIOPTERIS HENRYI; Christ et Gies. in Flora, lxxxii. (1899) 78.—Yunnan.

ARTHROPTERIS OBLITERATA, J. Sm. *Nephrodium obliteratum*, R. Br. *Nephrolepis ramosa*, Moore. *Arthropteris ramosa*, Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 587.—Formosa.

ASPIDIUM APIIFOLIUM, Schkuhr. *Sagenia apiifolia*, J. Sm.; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 120.—Szechuen.

BARBERI, C. Chr. *Polypodium Barberi*, Hook.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 628.—Formosa.

CICUTARIUM, Sw.; Diels in Engl. Jahrb. xxix. (1900) 192. *Polypodium cicutarium*, Linn.—Kwangtung: Szechuen: Formosa.

Var. TENUIFRONS, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 257.—Kweichau.

COADUNATUM, Wall.; Christ, *l. c.* xix. (1910) 13.—Kwangtung: Kweichau: Yunnan: Szechuen.

DECURRENS, Presl; C. Chr., Ind. Fil. (1905) 71.—Hongkong: Kweichau: Formosa: Loochoo.

DEVEXUM, Kunze. *A. membranaceum*, Hook.; Hook. & Bak., Syn. Fil. ed. ii. 259.—China, South: Formosa: Loochoo.

ASPIDIUM GRIFFITHII, Diels ; Matsum. & Hayat., Journ. Coll. Sc. Tokyo, xxii. (1906) 579. *Dictocline Griffithii*, Moore. *Hemionitis Griffithii*, Hook. fil. & Thoms.—Kwangtung : Kweichau : Yunnan : Fokien : Formosa.

LAMPROCAULON, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 117.—Szechuen.

laserpitiifolium, *Mett.* = Polystichum Standishii, *C. Chr.*

LATIFOLIUM, J. Sm. *Polypodium latifolium*, Forst. *Nephrodium latifolium*, Bak. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 575.—Formosa.

LEUZEANUM, Kunze. *Polypodium Leuzeanum*, Gaud. *Nephrodium Leuzeanum*, Hook. ; Hook. & Bak., Syn. Fil. ed. ii. 295.—Hongkong : China, South.

lobulatum, *Christ* = Dryopteris taiwanensis, *C. Chr.*

LONGICRURE, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 169.—Kweichau.

marginalis, *Wall.* = Dryopteris Filix mas, *Schott.*

MELANOCAULON, Blume. *Sagenia melanocaulon*, Moore ; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 257.—Kweichau.

MEMBRANIFOLIUM, Kunze. *Nephrodium membranifolium*, Presl. *Sagenia membranifolia*, Christ, *l. c.*—Kweichau : Yunnan.

PACHYPHYLLUM, Kunze ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 580.—Formosa.

PINFAENSE, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 172.—Kweichau.

POLYMORPHUM, Wall. *Nephrodium polymorphum*, Bak. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 576.—Kweichau : Formosa.

PYCNOPTEROIDES, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 116.—Szechuen.

reductum, *Bak.* = Polystichum Hancockii, *Diels.*

SINGAPORIANUM, Wall. ; C. Chr., Ind. Fil. (1905) 92.—China, Centr.

SUBPEDATUM, Diels. *Nephrodium subpedatum*, Harring. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 577.—Formosa.

SUBTRIPHYLLUM, Hook. *Polypodium subtriphyllum*, Hook. & Arn. *Nephrodium subtriphyllum*, Bak. ; Hook. & Bak., Syn. Fil. ed. ii. 296.—Hongkong : China, South : Formosa : Loochoo.

transitorium, *Christ* = Dryopteris tokioensis, *C. Chr.*

VARIOLOSUM, Wall. *Nephrodium variolosum*, Bak. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 578.—Kweichau : Formosa.

XANTHOMELAS, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 117.—Szechuen.

yunnanense, *Christ* = Dryopteris stenolepis, *C. Chr*

ASPLENIUM ACHILLEIFOLIUM, C. Chr., Ind. Fil. (1905) 99. *Adiantum acheilleifolium*, Lam. *Asplenium rutæfolium*, Kunze? *A. prolongatum*, Hook. —Hongkong: Kwangtung: Szechuen: Hupeh: Yunnan: Fokien.

ADIANTOIDES, C. Chr. *Trichomanes adiantoides*, Linn. *Asplenium falcatum*, Lam.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 602.—Formosa.

ADIANTUM NIGRUM, Linn. *A. cuneifolium*, Viv.; Christ in Bull. Acad. Géogr. Bot. xix. (1910) 13.—Kweichau: China, North.

Var. VEGETIUS, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 240.—Kweichau.

ADNATUM, Copel. in Philipp. Journ. Sc. iii. 5 (1908) 280.—Kwangtung.

ANOGRAMMOIDES, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 4.—Quelpart I.

ANTROPHYOIDES, Christ, *l. c.* (1909) Mém. 170.—Kweichau.

Beddomei, *Mett.* = A. crinicaule, *Hance.*

BELANGERI, Kunze. *A. Sampsoni*, Hance; Hook. & Bak., Syn. Fil. ed. ii. 223.—Kwangtung.

BILLETII, Christ in Bull. Sc. France et Belg. xxiii. (1898) 267.—Kweichau: Yunnan.

bireme, *C. H. Wright* = Diplazium Pullingeri, *J. Sm.*

BODINIERI, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 24. ? *A. cœnobiale*, Hance.—Kwangtung: Kweichau.

CARDIOPHYLLUM, Bak. in Ann. Bot. v. (1891) 311. *Microcarpium cardiophyllum*, Hance.—Hainan: Formosa.

CASTANEO-VIRIDE, Bak. *l. c.* 304.—Shantung.

CAVALERIANUM, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 173.—Kweichau.

CENTROCHINENSE, Christ, *l. c.* xiii. (1904) 111.—Kweichau.

CHEILOSORUM, Kunze; C. Chr., Ind. Fil. (1905) 105. *A. heterocarpon*, Wall.—Kwangtung: Formosa.

chlorophyllum, *Bak.* = Diplazium Pullingeri, *J. Sm.*

CŒNOBIALE, Hance in Journ. Bot. xii. (1874) 142. *A. fuscipes*, Bak. *Davallia pulcherrima*, Bak.—Kwangtung.

comptum, *Hance* = A. dimidiatum, *Sw.*

CRINICAULE, Hance; Hook. & Bak., Syn. Fil. ed. ii. 208. *A. Beddomei*, Mett.—Hongkong: Kwangtung: Yunnan: Szechuen.

CUNEATIFORME, Christ in Bull. Herb. Boiss. sér. 2, iv. (1904) 613.—Formosa.

CUNEATUM, Lam.; Benth., Fl. Hongk. (1861) 451.—Hongkong: Kweichau: Fokien: Formosa.

cuneifolium, *Viv.* = A. Adiantum nigrum, *Linn.*

DAVALLIOIDES, Hook.; Copel. in Philipp. Journ. Sc. iii. 5. (1908) 279.—Fokien: Formosa: Korea.

ASPLENIUM DIMIDIATUM, Sw.; Christ in Bull. Herb. Boiss. vii. (1899) 9. *A. comptum*, Hance.—Kwangtung: Kweichau: Yunnan.

ENSIFORME, Wall.; Christ, *l. c.* vi. (1898) 959.—Yunnan.

EXIGUUM, Bedd.; Christ in Bull. Soc. Bot. Ital. (1900) 262.—Kweichau: Yunnan: Shensi.

FINLAYSONIANUM, Wall.; Christ in Bull. Herb. Boiss. vi. (1898) 960.—Yunnan.

FONTANUM, Bernh.; Christ in Bull. Acad. Géogr. Bot. xix. (1910) 13. *Polypodium fontanum*, Linn.—Kweichau.

FORMOSANUM, Bak. *A. Hancockii*, Bak. in Journ. Bot. xxiii. (1885) 104.—Formosa.

FUGAX, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 53.—Kweichau: Yunnan: Szechuen.

furcatum, *Thunb.* = A. præmorsum, *Sav.*

GERMANICUM, Weis.; Forbes in Journ. Bot. xxi. (1883) 209.—Hongkong.

GRANDIFRONS, Christ in Bull. Herb. Boiss. vi. (1898) 959.—Yunnan.

GREVILLEI, Wall.; Christ, *l. c.*—Yunnan.

Hancei, *Bak.* = A. crinicaule, *Hance.*

HANCOCKII, Maxim. in Mél. Biol. xi. (1883) 868.—Formosa.

heterocarpum, *Wall.* = A. cheilosorum, *Kunze.*

HOLOPHYLLUM, Bak. in Ann. Bot. v. (1891) 301.—Formosa.

HOLOSORUM, Christ in Bull. Herb. Boiss. vii. (1899) 10.—Kwangtung: Yunnan.

INCISUM, Thunb.; Diels in Engl. Jahrb. xxix. (1900) 198.—Kwangtung: Kweichau: Yunnan: Szechuen: Shensi: Shantung: Manchuria: Korea.

INTERJECTUM, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 241.—Kweichau.

Var. ELATUM, Christ, *l. c.* 149.—Kweichau.

LACINIATUM, D. Don; Christ in Bull. Herb. Boiss. vii. (1899) 10.—Yunnan: Formosa.

LASERPITIIFOLIUM, Lam.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 604.—Hongkong: Kwangtung: Formosa.

Var. MORRISONENSE, Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 29—Formosa.

LATECUNEATUM, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 171.—Kweichau.

LEPTOPHYLLUM, Bak. in Kew Bull. 1906, 10.—Yunnan.

Var. MINUS, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 126.—Szechuen.

LOFAUENSE, Christ, *l. c.* xix. (1910) 142.—Kweichau.

longifolium, *D. Don* = Diplazium lobulosum, *Presl.*

ASPLENIUM LORICEUM, Christ. *A. Formosæ*, Christ in Bull. Herb. Boiss. iv. (1904) 613.—Formosa.

LOXOGRAMMOIDES, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 171.—Kweichau.

MACROPHYLLUM, Sw.; Benth., Fl. Hongk. (1861) 451.—Hongkong: Kwangtung: Formosa.

MICROTUM, Maxon in U.S. Dept. Agric., Contrib. Nat. Herb. xii. 411 (1909).—Kweichau: Szechuen: Hupeh: Kiangsu: Shensi.

mongolicum, *Franch.* = Athyrium mongolicum, *Diels.*

MOUPINENSE, Franch.; Diels in Engl. Jahrb. xxix. (1900) 198.—China, West.

NEESII, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 90.—Shensi.

nephrodioides, *Bak.* = Athyrium nephrodioides, *Christ.*

NIDUS, Linn.; Benth., Fl. Hongk. (1861) 450.—Hongkong: Kwangtung: Formosa: Loochoo.

NORMALE, D. Don; Diels in Engl. Jahrb. xxix. (1900) 198.—Hongkong: Kwangtung: Kweichau: Yunnan: Szechuen: Fokien: Korea.

OBSCURUM, Blume; Copel. in Philipp. Journ. Sc. iii. 5 (1908) 279. *Asplenium serræforme*, Mett.—Kwangtung.

OLDHAMI, Hance in Ann. Sc. Nat. Hist. sér. 5, Bot. v. (1866) 256.—Kwangtung: Formosa.

PARALLELOSORUM, Bak. in Kew Bull. 1906, 9.—Yunnan.

PEKINENSE, Hance; Christ in Bull. Herb. Boiss. vi. (1898) 960. *A. Sarellii*, var. *pekinense*, C. Chr.

Var. ALPINUM, Christ in Bull. Acad. Géogr. Bot. (1906) 129.—Szechuen.

Var. FŒNICULACEUM, Christ in Nuov. Giorn. Bot. Ital. xvii. (1910) 225.—Hupeh.

Var. NANUM, Christ, *l. c.*—Hupeh.

PINFAENSE, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 172.—Kweichau.

PLANICAULE, Wall.; Christ in Bull. Herb. Boiss. vi. (1898) 960. *A. laciniatum*, var. *planicaule*, C. Chr.—Yunnan.

POLYTRICHUM, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 172.—Kweichau.

PRÆMORSUM, Sw.; Christ, *l. c.* xvi. (1906) 129. *A. furcatum*, Thunb.—Yunnan: Szechuen: Formosa.

prolongatum, *Hook.* = A. achilleifolium, *C. Chr.*

RAHAÆENSE, Yabe; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 605.—Formosa.

resectum, *Sm.* = A. unilaterale, *Lam.*

rutæfolium, *Kunze* = A. achilleifolium, *C. Chr.*

ASPLENIUM RUTA MURARIA, Linn.; Kom. in Act. Hort. Petrop. xx. (1901) 138. —Manchuria.

Var. MATTHIOLI, Heuff.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 54.—Szechuen.

Var. SUBTENUIFOLIA, Christ, *l. c.*—Szechuen.

Sampsoni, *Hance* = A. Bellangeri, *Kunze.*

SARELLII, Hook. in Blakiston, Yangtsze, (1862) 363, 364.—China, Centr.: Manchuria: Korea: Loochoo.

Var. LATIUS, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1907) 89. —Shensi.

SEPTENTRIONALE, Hoffm.; Christ in Bull. Soc. Bot. Ital. 1900, 261.— Shensi.

SIMONSIANUM, Hook. *A. Simonsii*, Hook.; Christ in Bull. Acad. Géogr. Bot. xix. (1910) 4.—Quelpart I.

SINENSE, Bak. in Kew Bull. 1906, 9.—Yunnan.

SPELUNCÆ, Christ in Bull. Acad. Géogr. xiv. (1904) 113.—Kweichau.

TENERUM, Forst.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 605.—Formosa.

TENUIFOLIUM, D. Don; Christ in Bull. Herb. Boiss. vi. (1898) 959.— Yunnan: Kweichau.

Textori, *Miq.* = Diplazium Mettenianum, *C. Chr.*

TRICHOMANES, Linn.; Diels in Engl. Jahrb. xxix. (1900) 198.—China, Centr.: Formosa.

Var. CENTROCHINENSE, Christ in Bull. Acad. Géogr. Bot. xiv. (1904) 113.—Kweichau.

Var. MICROPHYLLUM, Christ in Bull. Herb. Boiss. sér. 2, iii. (1903).—Hupeh.

UNILATERALE, Lam. *A. resectum*, Sm.; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 238.—Hongkong: Kweichau: Kwangtung: Yunnan: Szechuen: Hupeh: Fokien: Formosa: Korea.

VARIANS, Wall.; Bak. in Journ. Bot. xxvii. (1889) 176.—Kweichau: Yunnan: Szechuen: Hupeh: Shensi.

WIGHTIANUM, Wall.; Christ in Bull. Herb. Boiss. vi. (1898) 960.— Yunnan: Formosa.

Var. MICROPHYLLUM, Bedd.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 606.—Formosa.

WILFORDII, Mett.; Bak. in Journ. Bot. xiii. (1875) 200.—Kweichau: Kiangsi: Korea.

WOODSIOIDES, Christ in Bull. Soc. Bot. Ital. ix. (1900) 261.—Kweichau: Yunnan: Shensi.

WRIGHTII, Eat.; Copel. in Philipp. Journ. Sc. iii. v. (1908) 280.— Kwangtung: Fokien: Formosa: Korea.

WRIGHTIOIDES, Christ in Bull. Acad. Géogr. Bot. xi (1902) 238.— Kweichau.

ASPLENIUM YUNNANENSE, Franch. in Bull. Soc. Bot. France, xxxii. (1885) 28. —Yunnan : Szechuen.

ATHYRIUM ACROSTICHOIDES, Diels in Engl. Jahr. xxix. (1900) 196. *Asplenium acrostichoides*, Sw. *A. thelypteroides*, Michx.—China, North and West : Manchuria : Korea.

Var. **HENRYI**, Christ in Bull. Herb. Boiss. vi. (1898) 961.—Yunnan.

ALATUM, Christ, *l. c.* 963.—Kweichau : Yunnan.

ANISOPTERUM, Christ, *l. c.* 962.—Yunnan : Hupeh.

ATKINSONI, Bedd. ; Christ, *l. c.* vii. (1899) 13.—Yunnan.

BIONDII, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 91.—Hupeh : Shensi.

BISERRULATUM, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 135.—Yunnan.

CAVALERIANUM, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 174.—Kweichau.

COREANUM, Christ in Bull. Herb. Boiss. sér. 2, ii. (1902) 827.—Korea.

CRENATUM, Rupr. ; Diels in Engl. Jahr. xxix. (1900) 197. *Aspidium crenatum*, Sommerf.—Shensi : Manchuria.

CYSTOPTEROIDES, Eat. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, (1906) 607.—Loochoo.

DELAVAYI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 47.—Yunnan : Szechuen : Hupeh.

DEMISSUM, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 5.—Quelpart I.

DOLOSUM, Christ, *l. c.* xvii. (1907) 136.—Yunnan.

DREPANOPTERUM, A. Br. *Polypodium drepanopterum*, Kunze. *P. oxyphyllum*, Moore ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 48.—Yunnan.

Var. **BREVICAUDATUM**, Christ in Lecomte, Not. Syst. i. (1909) 46. —Yunnan.

Var. **DECOMPOSITUM**, Christ, *l. c.* 47.—Yunnan.

Var. **FUNEBRE**, Christ, *l. c.* 46.—Yunnan.

FALLACIOSUM, Milde ; C. Chr., Ind. Fil. (1905) 141.—China, North : Manchuria.

FARGESII, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 49.—Szechuen.

FAURIEI, Mak. ; Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 133. *Nephrodium Fauriei*, Christ.—Yunnan.

FILIX FEMINA, Roth ; Diels in Engl. Jahrb. xxix. (1900) 196. *Polypodium Filix femina*, Linn.—China, North : Manchuria : Korea.

Var. **CRENATUM**, Milde ; Christ in Nuov. Giorn. Bot. Ital. (1907) 90. —Shensi.

ATHYRIUM FILIX FEMINA.

Var. DELTOIDEA, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 46.—Yunnan.

Var. DUCLOUXII, Christ, *l. c.*—Yunnan.

Var. ESQUIROLII, Christ in Bull. Acad. Géogr. Bot. (1910) 13.—Kweichau.

Var. FILIPES, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 46.—Kweichau: Hupeh.

Var. FISSIDENS, Christ, *l. c.* 45.—Kweichau: Szechuen: Quelpart I.

Var. MULTIDENTATUM, Milde; Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1907) 90.—Shensi.

Var. PALEOSUM, Milde; Christ in Lecomte, Not. Syst. i. (1908) 48.—Yunnan.

FIMBRIATUM, Moore; C. Chr., Ind. Fil. (1905) 142. *Aspidium fimbriatum*, Wall.—Yunnan.

FISSUM, Christ in Lecomte, Not. Syst. i. (1909) 47.—Yunnan.

FLACCIDUM, Christ in Fedde, Repert. Nov. Sp. v. (1908) 11.—Quelpart I.

GIRALDII, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 91.—Shensi.

GÖRINGIANUM, Moore; Diels in Engl. Jahrb. xxix. (1900) 196. *Aspidium Göringianum*, Kunze.—China, West: Korea.

HENRYI, Diels. *Asplenium Henryi*, Bak. in Journ. Bot. 1889, 176.—Yunnan: Szechuen: Hupeh.

IMBRICATUM, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 123.—Szechuen.

LASTREOIDES, Diels. *Asplenium lastreoides*, Bak. in Journ. Bot. 1888, 227.—Kweichau: Szechuen: Korea.

LONGIPES, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 48.—Yunnan.

MACDONELLII, Bedd.; Christ, *l. c.* 50.—Szechuen.

MACROCARPUM, Bedd.; C. Chr. Ind. Fil. (1905) 143. *Aspidium macrocarpum*, Blume.—Kweichau: Korea.

MATTHEWII, Copel. in Philipp. Journ. Sc. iii. v. (1908) 278.—Kwangtung.

MONGOLICUM, Diels in Engl. & Prantl, Pflanzenfam. I. iv. (1899) 224. *Asplenium mongolicum*, Franch.—China, North.

MUTICUM, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 147.—Kweichau.

NEPHRODIOIDES, Christ. *Asplenium nephrodioides*, Bak. in Journ. Bot. 1887, 170.—Hupeh: Yunnan.

NIGRIPES, Moore; Diels in Engl. Jahrb. xxix. (1900) 196. *Aspidium nigripes*, Blume.—China, South and West: Kiangsi: Shensi: Formosa: Korea.

Var. CLARKEI, C. Chr. *A. Clarkei*, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 174.—Kweichau.

ATHYRIUM NIGRIPES.

Var. ELONGATUM, Christ in Bull. Herb. Boiss. vii. (1899) 13.—Yunnan.

NIPONICUM, Hance; Diels in Engl. Jahrb. xxix. (1900) 196. *Asplenium niponicum*, Mett.—China, Centr. & North: Manchuria: Korea.

Var. ELATIUS, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 48.—Hupeh: Yunnan.

NUDICAULE, Copel. in Philipp. Journ. Sc. iii. v. (1908) 278.—Kwangtung.

OSHIMENSE, Christ in Bull. Herb. Boiss. sér. 2, i. (1901) 1017.—Loochoo.

oxyphyllum, *Moore* = A. drepanopterum, *A. Br.*

PACHYSORUM, Christ in Lecomte, Not. Syst. i. (1909) 48.—Kiangsu.

PETIOLOSUM, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 134.—Yunnan.

PSEUDOSETIGERUM, Christ, *l. c.* 146.—Kweichau.

PTERORACHIS, Christ in Bull. Herb. Boiss. iv. (1896) 668.—Korea.

PYCNOSORUM, Christ, *l. c.* sér. 2, ii. (1902) 827.—Korea.

RIGESCENS, Mak.; Christ in Bull. Acad. Géogr. Bot. xix. (1910) 5.—Korea.

ROSEUM, Christ in Bull. Herb. Boiss. vi. (1898) 961.—Yunnan.

SILVESTRII, Christ in Nuov. Giorn. Bot. Ital. n.s. xvii. (1910) 226.—Hupeh.

SPINULOSUM, Milde; Diels in Engl. Jahrb. xxix. (1900) 197. *Cystopteris spinulosa*, Maxim.—Yunnan: Szechuen: Shensi: Manchuria: Korea.

SUBSIMILE, Christ in Bull. Soc. Bot. Ital. 1898, 29.—Hupeh: Shensi.

tenuifrons, *Wall.* = A. nigripes, *Bl.*

thelypteroides, *Desv.* = A. acrostichoides, *Diels.*

UMBROSUM, Presl; Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 146.—Kweichau.

VEITCHII, Christ, *l. c.* xvi. (1906) 123.—Szechuen.

VIOLASCENS, Diels in Engl. Jahrb. xxix. (1900) 196.—China, South.

VIRIDIFRONS, Mak.; Christ in Bull. Acad. Géogr. Bot. xix. (1910) 4.—Korea.

VIVIPARUM, Christ, *l. c.* 13.—Kweichau.

WARDII, Mak.; Christ, *l. c.* xi. (1902) 246. *Asplenium Wardii*, Hook.—Szechuen: Korea.

Var. ELONGATUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 49.—Kweichau.

WILSONI, Christ in Bull. Herb. Boiss. sér. 2, iii. (1903) 512.—Hupeh.

YUNNANENSE, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 13.—Yunnan: Kweichau.

AZOLLA PINNATA, R. Br.; Bak. in Journ. Bot. xxvi. (1888) 231.—Hupeh: Formosa.

Var. africana, *Bak.*; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 560.—Formosa.

BLECHNUM EBURNEUM, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 233.—Kweichau: Szechuen: Hupeh.

FABERI, C. Chr. *Lomaria deflexa*, Bak. in Journ. Bot. xxvi. (1888) 226.—Szechuen.

HANCOCKII, Hance in Journ. Bot. xxi. (1883) 267. *Lomaria Hancockii*, Bak.—Formosa.

ORIENTALE, Linn.; Benth., Fl. Hongk. (1861) 444.—China, South: Formosa: Loochoo.

SPICANT, Linn.; Diels in Engl. Jahrb. xxix. (1900) 198.—Szechuen: Hupeh.

Var. NIPONICUM, Kunze; Diels, *l. c.*—China, South.

BOTRYCHIUM JAPONICUM, Underw.; Christ in Bull. Acad. Géogr. Bot. xix. (1910) 5. *B. daucifolium*, var. *japonicum*, Prantl.—Hupeh: Formosa: Korea.

LANUGINOSUM, Wall.; Christ in Bull. Herb. Boiss. vi. (1898) 973.—Yunnan.

LUNARIA, Sw.; Kom. in Act. Hort. Petrop. xx. (1901) 151. *Osmunda Lunaria*, Linn.—Yunnan: Szechuen: Manchuria.

MATRICARIÆ, Spreng.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 68. *Osmunda Matricariæ*, Schrank. *Botrychium rutæfolium*, R. Br.—Yunnan: Szechuen.

OBLIQUUM, Mühl.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 67.—Szechuen.

TERNATUM, Diels in Engl. Jahrb. xxix. (1900) 209. *Osmunda ternata*, Thunb.—Kweichau: Yunnan: Szechuen: Hupeh: Manchuria: Formosa.

VIRGINIANUM, Sw.; Diels, *l. c.* *Osmunda virginiana*, Linn.—Yunnan: Szechuen: Hupeh: Manchuria: Korea.

BRAINEA INSIGNIS, J. Sm.; Benth., Fl. Hongk. (1861) 460. *Boweringia insignis*, Hook.—Hongkong: Kwangtung: Yunnan: Formosa.

CAMPTOSORUS SIBIRICUS, Rupr. *Scolopendrium sibiricum*, Hook.; Diels in Engl. Jahrb. xxix. (1900) 197.—Kweichau: Shensi: Shantung: Korea.

CERATOPTERIS THALICTROIDES, Brongn.; Benth., Fl. Hongk. (1861) 443.—Hongkong: Fokien: Formosa.

Cheilanthes albofusca, Bak. in Kew Bull. 1895, 54.—Yunnan, Szechuen.

argentea, Kunze; Hook. & Bak., Syn. Fil. ed. ii. 142. *Pteris argentea*, Gmel.—China, West and North : Manchuria : Korea.

Var. **obscura**, Christ in Bull. Soc. Bot. Ital. vii. (1898) 27.—Szechuen : Hupeh : Shensi.

Bockii, Diels in Engl. Jahrb. xxix. (1900) 199.—Szechuen.

bullosa, Kunze; C. Chr., Ind. Fil. (1905) 172.—China.

cæsia, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 133.—Szechuen.

Dalhousiæ, Hook.; Christ, *l. c.* *C. farinosa*, var. *Dalhousiæ*, C. Chr.—Szechuen.

Delavayi, Bak. in Ann. Bot. v. (1891) 211.—Yunnan.

dubia, Hope; Christ in Lecomte, Not. Syst. i. (1909) 50.—Yunnan.

farinosa, Kaulf.; Christ in Bull. Herb. Boiss. vii. (1899) 8. *Pteris farinosa*, Forsk. — Kwangtung : Yunnan : Szechuen : Shensi : Formosa.

Var. **bullosa**, Christ in Bull. Soc. Bot. Ital. vii. (1898) 27.—Shensi.

Var. **obscura**, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 133.—Szechuen.

Fordii, Bak. in Journ. Bot. xvii. (1879) 304. *Adiantopsis Fordii*, C. Chr.—Kwangtung.

formosana, Hayat.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 612.—Formosa.

fragilis, Hook.; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 133.—Yunnan.

grevillioides, Christ in Lecomte, Not. Syst. i. (1909) 51.—Yunnan.

Hancockii, Bak. in Kew Bull. 1895, 54.—Yunnan.

Henryi, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 133.—Yunnan.

Kuhnii, Milde; Hook. & Bak., Syn. Fil. ed. ii. 476.—Manchuria.

Leveillei, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 149.—Kweichau.

mysurensis, Wall.; Hook. & Bak., Syn. Fil. ed. ii. 135.—China, South and West : Shensi : Formosa.

Var. **chusana**, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 149.—Kweichau.

Var. **Giraldii**, Christ in Lecomte, Not. Syst. i. (1909) 51.—Yunnan.

patula, Bak. in Journ. Bot. xxvi. (1888) 225.—Kweichau : Yunnan : Szechuen : Hupeh.

subrufa, Bak. in Kew Bull. 1906, 8.—Kweichau : Yunnan.

taliensis, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 58.—Yunnan.

tenuifolia, Sw.; Benth., Fl. Hongk. (1861) 449. *Trichomanes tenuifolium*, Burm.—China, South : Formosa.

Cheilanthes trichophylla, Bak. in Ann. Bot. v. (1891) 211.—Szechuen : Yunnan.

undulata, Hope & Wright in Gard. Chron. ser. 3, xxxiv. (1903) 397.—Yunnan.

Wilsoni, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 132.—Szechuen

Cheiropleuria bicuspis, Presl ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 641. *Polypodium bicuspe*, Blume.—Formosa : Loochoo.

Var. **integrifolia**, Eat. ; Matsum. & Hayat. *l. c.*—Formosa.

Cheiropteris Ebertii, Christ in Bull. Herb. Boiss. vi. (1898) 878.—Kwangtung.

Cibotium Barometz, J. Sm. *Polypodium Barometz*, Linn. *Cibotium glaucum*, J. Sm. ; Benth., Fl. Hongk. (1861) 460.—Hongkong : Kwangtung : Kweichau : Yunnan : Szechuen : Fokien : Formosa ! Loochoo.

Coniogramme fraxinea, Diels. *Diplazium fraxineum*, D. Don. *Gymnogramme fraxinea*, Bedd. ; Diels in Engl. Jahrb. xxix. (1900) 199. *Gymnogramme javanica*, Blume.—Kwangtung : Szechuen : Hupeh: Shensi : Manchuria : Korea.

Var. **robusta**, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 202.—Kweichau : Szechuen : Formosa.

japonica, Diels. *Hemionitis japonica*, Thunb. *Gymnogramme japonica*, Desv. ; Hook. & Bak., Syn. Fil. ed. ii. 390.—China, South : Formosa : Korea.

Cryptogramma Brunoniana, Wall. ; Diels in Engl. Jahrb. xxix. (1900) 200. *C. crispa*, var. *Brunoniana*, Bak.—China, West and North : Formosa.

crispa, R. Br. ; Bak. in Journ. Bot. xxvi. (1888) 226. *Osmunda crispa*, Linn.—Szechuen.

Var. **sinensis**, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 135.—Szechuen.

Stelleri, Prantl ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 60. *Pteris Stelleri*, Gmel. *Pellæa gracilis*, Hook.—Yunnan.

Cyathea austrosinica, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 141.—Kweichau.

Hancockii, Copel. in Philipp. Journ. Sc. iv. (1909) 37.—China, South : Formosa.

spinulosa, Wall. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 570.—Kwangtung : Formosa : Loochoo.

CYCLOPHORUS ACROCARPUS, C. Chr. *Nipholobus acrocarpus*, Christ et Gies. in Bull. Acad. Géogr. Bot. xi. (1902) 221.—Yunnan.

ADNASCENS, Desv. *Polypodium adnascens*, Sw.; Benth., Fl. Hongk. (1861) 458.—Hongkong : Kwangtung : Yunnan : Formosa.

ASSIMILIS, C. Chr. *Polypodium assimile*, Bak. in Journ. Bot. xiii. (1875) 201.—Kwangtung : Kiangsi.

BEDDOMEANUS, C. Chr. *Nipholobus costatus*, Gies.; Diels in Engl. Jahrb. xxix. (1900) 207.—China, South.

CALVATUS, C. Chr. *Polypodium calvatum*, Bak. in Journ. Bot. xvii. (1879) 304.—Kwangtung : Kweichau : Szechuen.

CAVALERIANUS, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 107.—Kweichau.

DRAKEANUS, C. Chr. *Polypodium Drakeanum*, Franch. in Nouv. Arch. Mus. Hist. Nat. Par. sér. 2, vii. (1883) 165.—Kweichau : Yunnan : Szechuen : Hupeh : Kiangsi : Shensi.

Forma ELONGATA, Christ; Diels in Engl. Jahrb. xxix. (1900) 207.—China, Centr.

GRALLA, C. Chr. *Nipholobus Gralla*, Gies.; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 221.—Kweichau : Yunnan.

HASTATUS, C. Chr. *Acrostichum hastatum*, Thunb. *Cyclophorus tricuspis*, Sw.; Christ, *l. c.* xix. (1910) 5.—Korea.

FLOCCULOSUS, C. Chr. *Polypodium flocculosum*, D. Don; Christ, *l. c.* vi. (1898) 872.—Yunnan.

INÆQUALIS, C. Chr. *Nipholobus inæqualis*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 25.—Yunnan : Szechuen : Hupeh.

LINEARIFOLIUS, C. Chr. *Nipholobus linearifolius*, Hook.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 68.—China, South : Formosa : Manchuria : Korea.

LINGUA, Desv. *Acrostichum Lingua*, Thunb. *Polypodium Lingua*, Sw.; Benth., Fl. Hongk. (1861) 458.—China : Formosa : Manchuria : Korea.

MALACOPHYLLUS, C. Chr. *Polypodium mollissimum*, Christ in Bull. Herb. Boiss. vii. (1899) 5.—Yunnan.

MARTINI, C. Chr. *Nipholobus Martini*, Christ in Bull. Soc. Bot. France, Mém. i. (1905) 23.—Kweichau : Yunnan.

NUDUS, C. Chr., Ind. Fil. (1905) 200. *Nipholobus nudus*, Gies.—China, South.

PEKINENSIS, C. Chr. *Polypodium Davidii*, Bak. in Ann. Bot. v. (1891) 471.—Kweichau : Yunnan : Shensi.

PETIOLOSUS, C. Chr. *Polypodium petiolosum*, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 96.—China, Centr. and North : Korea.

POLYDACTYLUS, C. Chr. *Polypodium polydactylum*, Hance in Journ. Bot. xxi. (1883) 269.—Formosa.

CYCLOPHORUS POROSUS, Presl. *Polypodium porosum*, Wall. *Polypodium fissum*, Bak.; Hook. & Bak., Syn. Fil. ed. ii. 351.—Szechuen : Formosa.

SHEARERI, C. Chr. *Polypodium Sheareri*, Bak. in Journ. Bot. xiii. (1875) 201.—Kiangsi : Szechuen : Hupeh : Shensi.

STRICTUS, C. Chr. *Nipholobus strictus*, Kunze ; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 221.—Kweichau : Yunnan : Szechuen.

Var. MAJOR, Christ, *l. c.* xvi. (1906) 109.—Szechuen.

SUBFURFURACEUS, C. Chr. *Polypodium subfurfuraceum*, Hook. *Nipholobus subfurfuraceus*, Bedd. ; Christ, *l. c.* xi. (1902) 223.—Kweichau : Yunnan.

TÆNOIDES, C. Chr. *Polypodium angustissimum*, Bak. in Ann. Bot. v. (1891) 472.—Kweichau : Yunnan : Szechuen : Chekiang : Hupeh : Shensi.

TAIWANENSIS, C. Chr. *Polypodium taiwanense*, Christ in Warb. Monsunia, i. (1901) 60.—Formosa.

tricuspis, *Sw.* = C. hastatus, *C. Chr.*

VITTARIOIDES, Christ in Bull. Acad. Géogr. Bot. xviii. (1909) Mém. 175.—Kweichau.

ZIPHIOIDES, C. Chr. *Nipholobus ziphioides*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 25.—Kweichau.

CYRTOMIUM falcatum, *Presl* = Polystichum falcatum, *Diels.*

HEMIONITIS, Christ in Bull. Acad. Géogr. xix. (1910) 138.—Kweichau.

CYSTOPTERIS FRAGILIS, Bernh. ; Diels in Engl. Jahrb. xxix. (1900) 188. *Polypodium fragilis*, Linn.—China, West : Manchuria.

JAPONICA, Luerss. ; Matsum., Ind. Pl. Japon. (1904) 301.—Loochoo.

SETOSA, Bedd. ; Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 117. *Davallia setosa*, Bak.—Kweichau.

SUDETICA, A. Br. & Milde. *C. moupinensis*, Franch. ; Diels in Engl. Jahrb. xxix. (1900) 188.—Yunnan : Szechuen : Manchuria.

DAVALLIA ATHAMANTICA, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 65.—Yunnan.

BULLATA, Wall.; Palibin in Act. Hort. Petrop. xix. (1901) 41.—China, North : Korea : Formosa.

CLARKII, Bak. in Journ. Bot. xxvi. (1888) 225. *Davallia Delavayi*, Bedd.—Yunnan : Szechuen : Formosa.

DENTICULATA, Mett. *Adiantum denticulatum*, Burm. *Davallia elegans*, Sw. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 590.—Formosa.

DISSECTA, J. Sm.; Matsum. & Hayat. *l. c.* 589.—Formosa.

Davallia divaricata, Blume; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 589.—Hongkong: Kwangtung: Formosa.
elegans, *Sw.* = D. denticulata, *Mett.*
Griffithiana, Hook.; Benth., Fl. Hongk. (1861) 462.—Hongkong: Kwangtung: Yunnan: Fokien: Chusan: Formosa.
Henryana, Bak. in Kew Bull. 1906, 8.—Yunnan.
hymenophylloides, Kuhn; Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 26. *Aspidium hymenophylloides*, Blume.—Formosa.
immersa, Wall.; Christ in Bull. Herb. Boiss. vi. (1898) 970.—Yunnan.
membranulosa, Wall.; C. Chr., Ind. Fil. (1905) 212.—Yunnan.
multidentata, Diels in Engl. Jahrb. xxix. (1900) 195. *Aspidium multidentatum*, Wall.—Szechuen.
nephrodioides, Bak.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 590.—Formosa.
perdurans, Christ in Bull. Herb. Boiss. vi. (1898) 970.—Szechuen: Yunnan.
platylepis, Bak. in Kew Bull. 1898, 229.—Yunnan.
polypodioides, *Benth.* = Microlepia Hancei, *Prantl.*
pulcherrima, *Bak.* = Asplenium cœnobiale, *Hance.*
pulchra, D. Don; C. Chr., Ind. Fil. (1905) 213.—Yunnan.
    Var. **Delavayi**, Bedd.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 65.—Yunnan.
rigidula, Bak. in Kew Bull. 1906, 8.—Yunnan: Kweichau.
solida, Sw.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 591. *Trichomanes solida*, Forst.—Formosa.
    Var. **sinensis**, Christ in Bull. Herb. Boiss. vii. (1899) 18.—Yunnan.
tenuifolia, *Sw.* = Odontosoria chinensis, *J. Sm.*
yunnanensis, Christ, Bull. Herb. Boiss. vi. (1898) 970.—Yunnan.

Dennstaedtia Formosæ, Christ, *l. c.* sér. 2, iv. (1904) 617.—Formosa.
moluccana, Moore; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 594. *Dicksonia moluccana*, Blume.—Formosa.
scabra, Moore; Christ in Bull. Herb. Boiss. vi. (1898) 972. *Dicksonia scabra*, Wall.—Kweichau: Yunnan: Szechuen: Formosa: Korea.
scandens, Moore; Matsum. & Hayat. *l. c.* 595. *Dicksonia scandens*, Blume.—Formosa.
Smithii, Moore. *Dicksonia Smithii*, Hook.; Matsum. & Hayat. *l. c.* 569.—Formosa.

Dicalpe aspidioides, Blume; Christ in Bull. Herb. Boiss. vi. (1898) 972.—Yunnan: Kweichau: Szechuen.

Diplaziopsis javanica, C. Chr. *Asplenium javanicum*, Blume. *Allantodia javanica*, Trevis. *A. Brunoniana*, Wall.; Bak. in Journ. Bot. xxvi. (1888) 227.—Kweichau: Yunnan: Szechuen: Formosa.

Diplazium bantamense, Blume; Hook. & Bak., Syn. Fil. ed. ii. 231.—Hongkong: China, South: Formosa.

calogramma, Christ in Lecomte, Not. Syst. i. (1909) 45.—Yunnan.

Cavalerii, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 114.—Kweichau.

chinense, C. Chr. *Asplenium chinense*, Bak.; Hook. & Bak., Syn. Fil. ed. ii. 237.—Kwangtung: Kiangsu.

Döderleinii, Mak. in Bot. Mag. Tokyo, xiii. (1899) 14. *Asplenium Döderleinii*, Luerss.—Formosa: Loochoo.

doodinervum, Yabe; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 597.—Formosa.

epirachis, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 51.—Kweichau.

esculentum, Sw. *Hemionitis esculentum*, Retz. *Asplenium esculentum*, Presl; Benth., Fl. Hongk. (1861) 452.—Hongkong: Kwangtung: Yunnan: Formosa: Loochoo.

Fauriei, Christ in Bull. Herb. Boiss. sér. 2, i. (1901) 1015.—Loochoo.

flaccidum, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 125.—Szechuen.

frondosum, J. Sm.; Christ in Lecomte, Not. Syst. i. (1909) 14. *Asplenium latifolium*, var. *frondosum*, Blandford.—Kweichau: Yunnan.

hirtipes, Christ in Bull. Herb. Boiss. vii. (1899) 11.—Yunnan.

japonicum, Bedd. *Asplenium japonicum*, Thunb. *A. Schkuhrii*, Hook.; Benth., Fl. Hongk. (1861) 452.—China: Formosa: Korea.

Var. **coreanum**, Bak. in Journ. Linn. Soc., Bot. xvi. (1878) 29.—Formosa: Korea.

Var. **Oldhami**, Bak.; Hook. & Bak., Syn. Fil. ed. ii. 235.—Shensi: Formosa.

lanceum, Presl. *Asplenium lanceum*, Thunb.; Benth., Fl. Hongk. (1861) 451.—China, South: Hupeh: Formosa: Korea.

latifolium, Moore; Diels in Engl. Jahrb. xxix. (1900) 197. *Asplenium latifolium*, D. Don. *A. dilatatum*, Hook.; Benth. Fl. Hongk. (1861) 452.—China, South: Hupeh: Formosa: Loochoo.

Var. **cyclolobum**, Christ in Bull. Herb. Boiss. iv. (1894) 614.—Formosa.

Var. **eurobasis**, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 51.—Kweichau.

Var. **giganteum**, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 51. *Gymnogramme gigantea*, Bak.—Hupeh.

DIPLAZIUM LOBULOSUM, Presl. *Asplenium lobulosum*, Wall. *Diplazium longifolium*, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 148.—Kweichau.

MAKINOI, Yabe ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 600.—Formosa.

MAXIMUM, C. Chr. *Asplenium maximum*, D. Don ; Bak. in Journ. Bot. xiii. (1875) 200.—Hongkong ; Kwangtung ; Kiangsi.

MEGAPHYLLUM, Christ in Bull. Herb. Boiss. vi. (1898) 961. *Asplenium megaphyllum*, Bak.—Kweichau : Yunnan.

METTENIANUM, C. Chr., Ind. Fil. (1905) 236. *Asplenium Mettenianum*, Miq. *Diplazium Textori*, Mak.—Kweichau.

PETERSENII, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 245. *Asplenium Petersenii*, Kze. *A. lasiopteris*, Mett. — Kwangtung : Kweichau : Yunnan : Szechuen.

PLATYPHYLLUM, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 148.—Kweichau.

POLYPODIOIDES, Blume ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 600.—Formosa.

Var. HENRYI, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 127.—Yunnan : Szechuen.

Var. SINENSE, Christ, *l. c.*—Yunnan : Szechuen.

PULLINGERI, J. Sm. *Asplenium Pullingeri*, Bak. in Gard. Chron. n. s. iv. (1875) 484. *A. chlorophyllum*, Bak. *A. bireme*, C. H. Wright.—Kwangtung : Fokien : Formosa.

RUDE, Christ. *Diplazium hemionitideum*, Christ in Bull. Herb. Boiss. vii. (1899) 12.—Yunnan.

SILVATICUM, Sw. *Callipteris silvatica*, Bory. *Asplenium silvaticum*, Presl ; Benth., Fl. Hongk. (1861) 452.—Hongkong : Kwangtung : Fokien : Formosa.

SQUAMIGERUM, Christ. *Asplenium squamigerum*, Mett. ; Bak. in Journ. Bot. xxv. (1887) 171.—Hupeh : Szechuen.

VEITCHII, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 125.—Szechuen.

VIRESCENS, Kunze ; Christ, *l. c.* xi. (1902) 245.—Kweichau : Quelpart I.

VIRIDISSIMUM, Christ in Lecomte, Not. Syst. i. (1909) 13.—Yunnan.

WICHURÆ, Diels. *Asplenium Wichuræ*, Mett. ; Bak. in Journ. Bot. xiii. (1875) 200.—Kweichau : Yunnan : Szechuen : Kiangsi : Formosa : Korea.

ZEYLANICUM, Moore. *Asplenium zeylanicum*, Hook. *Athyrium zeylanicum*, Copel. in Philipp. Journ. Sc. iii. v. (1908) 279.—Hongkong : Kwangtung : Fokien.

DIPTERIS CHINENSIS, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 109.—Kweichau.

DIPTERIS CONJUGATA, Reinw. *Polypodium Horsfieldii*, R. Br. *Dipteris Horsfieldii*, Bedd. ; Christ in Bull. Herb. Boiss. vi. (1898) 880.—Yunnan : Formosa : Loochoo.

DORYOPTERIS CONCOLOR, Kuhn. *Pteris concolor,* Langs. et Fisch. *Pellæa geraniæfolia*, Fée ; Hook. & Bak., Syn. Fil. ed. ii. 146.—China : Korea.

DUCLOUXII, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 231.—Yunnan.

MICHELII, Christ, *l. c.* xix. (1910) 14.—Kweichau.

MURALIS, Christ, *l. c.* xiii. (1904) 111.—Kweichau.

SQUAMOSA, C. Chr. *Pellæa squamosa*, Hope & Wright in Journ. Linn. Soc., Bot. xxxv. (1903) 518.—Yunnan.

VEITCHII, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 134.—Szechuen.

DRYMOGLOSSUM CARNOSUM, J. Sm. ; Benth., Fl. Hongk. (1861) 444. *Nothochlæna carnosa*, Wall.—China : Formosa.

MICROPHYLLUM, C. Chr., Ind. Fil. (1905) 246. *Lemmaphyllum microphyllum*, Presl. *Drymoglossum subcordatum*, Fée.—China : Korea : Formosa.

OBOVATUM, Christ in Journ. de Bot. xix. (1905) 73.—Formosa.

DRYNARIA Baronii, *Diels* = D. reducta, *Christ.*

DELAVAYI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 22.—Szechuen.

FORTUNEI, J. Sm. ; Diels in Engl. Jahrb. xxix. (1900) 207. *Polypodium Fortunei*, Kze.—China, South : Hupeh : Szechuen.

Linnæi = D. sparsisora, *Moore.*

MOLLIS, Bedd. ; C. Chr., Ind. Fil. (1905) 248.—China, Centr.

Var. YUNNANENSIS, Christ in Bull. Herb. Boiss. vii. (1899) 6.—Yunnan.

PROPINQUA, J. Sm. *Polypodium propinquum*, Wall. ; Bak. in Journ. Bot. 1888, 230.—Kweichau : Yunnan : Szechuen.

Var. MESOSORA, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 108.—Szechuen.

QUERCIFOLIA, J. Sm. ; C. Chr., Ind. Fil. (1905) 249. *Polypodium quercifolium*, Linn.—China, South.

REDUCTA, Christ. *Polypodium Baronii*, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 100.—Szechuen : Shensi.

SINICA, Diels in Engl. Jahrb. xxix. (1900) 208.—China, Centr.

SPARSISORA, Moore ; Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 144. *Polypodium sparsisorum*, Desv. *Drynaria Linnæi*, Bedd.—Kweichau.

DRYOPTERIS AFRICANA, C. Chr. *Polypodium africanum*, Desv. *Gymnogramme Totta*, Schlecht.; Hook. & Bak., Syn. Fil. ed. ii. 376.—China: Korea.

AMAUROPHYLLA, C. Chr. *Phegopteris amaurophylla*, Christ in Bull. Herb. Boiss. vii. (1899) 14.—Yunnan.

ANGUSTIFRONS, O. Kuntze. *Lastrea angustifrons*, Moore. *Aspidium angustifrons*, Miq.; Matsum., Ind. Pl. Japon. (1904) 383.—Loochoo.

APICIDENS, C. Chr. *Polypodium apicidens*, Bak. in Kew Bull. 1895, 54.—Yunnan.

AURITA, C. Chr. *Gymnogramme aurita*, Hook. *Aspidium auritum*, Christ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 579.—Formosa.

AUSTROSINENSIS, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 145.—Kweichau.

BARBIGERA, O. Kuntze. *Lastrea barbigera*, Moore. *Aspidium barbigerum*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 43.—Yunnan.

BASISORA, Christ in Lecomte, Not. Syst. i. (1909) 44.—Yunnan.

BEDDOMEI, O. Kuntze. *Nephrodium Beddomei*, Bak. in Journ. Bot. xxv. (1887) 171.—Yunnan: Formosa.

BLANDFORDII, Christ in Lecomte, Not. Syst. i. (1909) 42. *Aspidium Blandfordii*, Hope.—Kiangsu.

BODINIERI, C. Chr. *Aspidium Bodinieri*, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 248. *Nephrodium cyclodioides*, Bak.—Kweichau: Szechuen.

BORYANA, C. Chr. *Aspidium Boryanum*, Willd.; Christ, *l. c.* 256.—Kweichau.

BRACHYODUS, O. Kuntze; Christ, *l. c.* xvii. (1907) 145. *Polypodium brachyodum*, Kunze. *Nephrodium brachyodum*, Hook.—Kweichau.

BRAINIOIDES, C. Chr. *Polypodium brainioides*, Bak. in Journ. Bot. xxvi. (1888) 229.—Szechuen: Kwangtung.

BRUNNEA, C. Chr. *Polypodium brunneum*, Wall. *Aspidium distans*, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 253. *Polypodium distans*, D. Don.—Kweichau: Yunnan: Szechuen: Hupeh: Formosa: Loochoo.

Var. CORIACEA, Christ, *l. c.* (1909) Mém. 176.—Kweichau.

CALCARATA, O. Kuntze. *Nephrodium calcaratum*, Blume. *Aspidium ciliatum*, Wall.; Benth., Fl. Hongk. (1861) 455.—Hongkong: Kweichau: Yunnan: Szechuen.

CALLOPSIS, C. Chr. *Aspidium callopsis*, Franch. et Savat. *Nephrodium callopsis*, Palibin in Act. Hort. Petrop. xix. (1901) 40.—Yunnan: Korea.

CANA, O. Kuntze; Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 144. *Lastrea cana*, J. Sm.—Kweichau.

DRYOPTERIS CAVALERII, C. Chr. *Aspidium Cavalerii*, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 116.—Kweichau.

CHRYSOCOMA, C. Chr. *Aspidium Filix mas*, var. *Chrysocoma*, Christ in Bull. Herb. Boiss. vi. (1898) 966.—Kweichau : Yunnan.

CLARKII, O. Kuntze. *Nephrodium Clarkii*, Bak. in Journ. Bot. xxvi. (1888) 228.—Szechuen.

CNEMEDARIA, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 140.—Kweichau.

COCHLEATA, C. Chr. *Nephrodium cochleatum*, D. Don. *N. Filix mas*, var. *cochleatum*, Bak. *Aspidium cochleatum*, Spreng. ; Christ in Bull. Herb. Boiss. vi. (1898) 967.—Yunnan.

CRENATA, O. Kuntze. *Polypodium crenatum*, Forsk. *Nephrodium odoratum*, Bak. ; Hook. & Bak., Syn. Fil. ed. ii. 280. *Nephrodium Fordii*, Bak.—China, South : Hupeh : Kiangsi : Shensi : Formosa.

CYSTOLEPIDOTA, C. Chr. *Aspidium cystolepidotum*, Miq. ; Palibin in Act. Hort. Petrop. xix. (1901) 40.—Fokien : Korea.

DECURRENTI-ALATA, C. Chr. *Gymnogramme decurrenti-alata*, Hook. *Athyrium decurrenti-alata*, Copel. in Philipp. Journ. Sc. iii. v. (1908) 279.—Fokien.

DECURSIVO-PINNATA, O. Kuntze. *Nephrodium decursivo-pinnatum*, Bak. ; Hook. & Bak. *l. c.* 259.—China : Formosa : Korea.

DECIPIENS, O. Kuntze. *Nephrodium decipiens*, Hook. ; Hook. & Bak. *l. c.* 260.—China, South : Loochoo.

DICKINSII, C. Chr. *Aspidium Dickinsii*, Franch. et Savat. *Nephrodium Dickinsii*, Bak. in Journ. Bot. xxvi. (1888) 228.—Kweichau: Yunnan : Hupeh.

DIELSII, C. Chr. *Polypodium stenopteron*, Bak. *l. c.* 229. *Nephrodium stenopterum*, Diels.—Hupeh.

DIFFRACTA, C. Chr. *Nephrodium diffractum*, Bak. in Kew Bull. 1898, 230.—Yunnan : Kweichau.

DISSECTA, O. Kuntze. *Polypodium dissectum*, Forst. *Aspidium dissectum*, Christ in Bull. Herb. Boiss. vii. (1899) 17.—Yunnan.

DISSITIFOLIA, C. Chr. *Polypodium dissitifolium*, Bak. in Kew Bull. 1905, 54.—Yunnan.

DUCLOUXII, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 139.—Yunnan.

EATONI, O. Kuntze. *Nephrodium Eatoni*, Bak.; Hook. & Bak. *l. c.* 276.—Kwangtung : Formosa : Loochoo.

Var. FORMOSANA, Harring. in Journ. Linn. Soc., Bot. xvi. (1878) 29.—Formosa.

EBERHARDTII, Christ, var. GLABRATA, Christ in Lecomte, Not. Syst. i. (1909) 38.—Yunnan.

DRYOPTERIS ENEAPHYLLA, C. Chr. *Nephrodium eneaphyllum*, Bak. in Journ. Bot. xxv. (1887) 170.—Hupeh.

ERUBESCENS, C. Chr. ; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 251. *Polypodium erubescens*, Wall.—Kweichau : Yunnan : Szechuen.

ERYTHROSORA, O. Kuntze. *Aspidium erythrosorum*, Eat. *Nephrodium erythrosorum*, Diels in Engl. Jahrb. xxxix. (1900) 190.—China, South : Saensi : Korea.

Var. OBTUSA, Mak. ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 40.—Szechuen : Quelpart I.

ESQUIROLII, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 144.—Kweichau.

FABERI, C. Chr. *Nephrodium Faberi*, Bak. in Ann. Bot. v. (1891) 316.—Chekiang.

FARGESII, C. Chr. *Aspidium Fargesii*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 42.—Yunnan : Szechuen.

FILIX MAS, Schott. *Polypodium Filix mas*, Linn. *Nephrodium Filix mas*, Diels in Engl. Jahrb. xxix. (1900) 190.—China : Korea.

Var. CHAMPIONI, C. Chr. ; Benth. (pro specie), Fl. Hongk. (1861) 456.—Hongkong.

Var. CRENATA, C. B. Clarke ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 38.—Yunnan.

Var. GIRALDII, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 94.—Shensi.

Var. MARGINATUM, Wall. ; Christ in Bull. Herb. Boiss. vi. (1898) 967.—Yunnan.

Var. NIDUS, C. B. Clarke ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 38.—Yunnan.

Var. NORMALIS, C. B. Clarke; Christ in Bull. Acad. Géogr. Bot. xix. (1910) 6.—Yunnan : Korea.

Var. OMEIENSE, Christ, *l. c.* xvi. (1906) 117.—Szechuen.

FLACCIDA, O. Kuntze ; Christ in Bull. Herb. Boiss. vi. (1898) 968. *Aspidium flaccidum*, Blume.—Kweichau : Yunnan : Korea.

FLEXILIS, C. Chr. *Aspidium flexile*, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 252.—Szechuen : Kweichau.

FORMOSANA, C. Chr. *Aspidium formosanum*, Christ ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 579.—Formosa.

FRAGRANS, Schott. *Polypodium fragrans*, Linn. *Nephrodium fragrans*, Rich. ; Kom. in Act. Hort. Petrop. xx. (1901) 121.—Korea.

FRUCTUOSA, C. Chr. *Aspidium fructuosum*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 38.—Yunnan.

GIRALDII, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 15.—Kweichau.

DRYOPTERIS GONGYLODES, O. Kuntze. *Aspidium* (*goggilodus*), Schkuhr· *A. unitum*, Mett.; Benth., Fl. Hongk. (1861) 456.—Hongkong: Kwangtung: Formosa: Loochoo: Korea.

GRACILESCENS, O. Kuntze. *Aspidium gracilescens*, Blume. *Nephrodium gracilescens*, Hook.; Diels in Engl. Jahrb. xxix. (1900) 189.—China, South: Formosa: Korea.

Var. CHINENSIS, Christ in Lecomte, Not. Syst. i. (1909) 40.—Yunnan.

Var. DUCLOUXII, Christ in Lecomte, Not. Syst. i. (1909) 40.—Yunnan.

Var. HIRSUTIPES, C. B. Clarke. *Lastrea hirsutipes*, Bedd. in Herb. Matthew.—Hongkong.

GROSSA, C. Chr. *Phegopteris grossa*, Christ in Bull. Herb. Boiss. vii. (1899) 13.—Yunnan.

GYMNOGRAMMOIDES, C. Chr. *Polypodium gymnogrammoides*, Bak. in Journ Bot. xxvi. (1888) 229. *Nephrodium gymnogrammoides*, Diels.—Szechuen: Kweichau.

GYMNOPHYLLA, C. Chr. *Nephrodium gymnophyllum*, Bak. in Journ. Bot. xxv. (1887) 170.—Hupeh.

HENDERSONI, C. Chr. *Lastrea Hendersoni*, Bedd. *Aspidium spectabile*, Wall.; Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 117.—Kweichau: Yunnan.

HETEROCARPA, O. Kuntze. *Aspidium heterocarpum*, Blume. *Nephrodium heterocarpum*, Moore; Hook. & Bak., Syn. Fil. ed. ii. 293.—Hongkong: Kwangtung: Fokien.

HIRTIPES, O. Kuntze. *Aspidium hirtipes*, Blume. *Nephrodium hirtipes*, Hook.; Diels in Engl. Jahrb. xxix. (1900) 188.—Kweichau: Szechuen: Hupeh: Quelpart I.

HIRTOSPARSA, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 176.—Kweichau.

INCRASSATA, C. Chr. *Phegopteris incrassata*, Christ in Bull. Herb. Boiss. vi. (1898) 963.—Yunnan.

JACULOSA, C. Chr. *Aspidium jaculosum*, Christ in Bull. Herb. Boiss. sér. iv. (1904) 615.—Formosa.

JUXTAPOSITA, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 138.—Yunnan.

KHASIANA, C. Chr. *Polypodium elongatum*, Wall. *Aspidium cuspidatum*, Mett.; Christ, *l. c.* xi. (1902) 250. *Aspidium yunnanense*, Christ.—Yunnan: Kweichau.

LABORDII, C. Chr. *Aspidium Labordii*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 40.—Kweichau.

DRYOPTERIS LACERA, O. Kuntze. *Polypodium lacerum*, Thunb. *Nephrodium lacerum*, Bak. in Journ. Bot. xxvi. (1888) 228.—Hupeh : Shantung : Korea.

Var. OBTUSA, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 39.—Hupeh.

LÆTA, C. Chr. *Nephrodium lætum*, Kom. in Act. Hort. Petrop. xx. (1901) 124.—Manchuria.

latipinna, *O. Kuntze*=D. parasitica, var. latipinna, *O. Kuntze*.

LAXA, C. Chr. *Aspidium laxum*, Franch. et Savat. *Nephrodium laxum*, Diels in Engl. Jahrb. xxix. (1900) 189.—Shensi.

LEPIDORACHIS, C. Chr. *Polypodium rheosorum*, Bak. in Ann. Bot. v. (1891) 457.—Chekiang.

LEPIGERA, O. Kuntze. *Nephrodium lepigerum*, Bak. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 579.—Formosa.

LEUCOSTIPES, C. Chr. *Nephrodium leucostipes*, Bak. in Journ. Bot. xxvi. (1888) 105.—Formosa.

LEVEILLEI, Christ in Bull. Acad. Géogr. Bot. (1909) Mém. 176.—Kweichau.

LINNÆANA, C. Chr. *Polypodium Dryopteris*, Linn. ; Hook. & Bak., Syn. Fil. ed. ii. 309.—China : Manchuria.

Var. LONGULUM, Christ in Bull. Soc. France, lii. Mém. i. (1905) 35.—Szechuen.

LOFAUENSIS, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 143.—Kweichau.

LONGIFRONS, Christ, *l. c.* xvii. (1907) 146. *Meniscium longifrons*, Wall.—Kweichau.

LUNANENSIS, C. Chr. *Aspidium lunanense*, Christ in Bull. Herb. Boiss. vi. (1898) 966.—Kweichau : Yunnan.

MACARTHYI, C. Chr. *Nephrodium Macarthyi*, Bak. *N. puberulum*, Bak. in Journ. Bot. xiii. (1875) 201.—Kiangsi.

MIQUELIANA, C. Chr. *Aspidium Miquelianum*, Maxim. *Nephrodium Miquelianum*, Yabe ; Kom. in Act. Hort. Petrop. xx. (1901) 123.—Manchuria : Korea.

MOLLISSIMA, C. Chr. *Aspidium mollissimum*, Christ in Bull. Herb. Boiss. vi. (1898) 968.—Yunnan.

MONTICOLA, C. Chr. *Nephrodium monticolum*, Mak. ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 39. *Aspidium Goldieanum*, Christ (*non* Hook.).—Yunnan : Korea.

MOULMEINENSIS, C. Chr. *Nephrodium moulmeinense*, Bedd. *Aspidium moulmeinense*, Christ in Bull. Acad Géogr. Bot. xi. (1902) 247.—Kweichau : Yunnan : Hupeh.

NIPPONICA, C. Chr. *Aspidium nipponicum*, Franch. et Savat. ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 35.—China, North and West : Korea.

DRYOPTERIS OCHTHODES, C. Chr. *Aspidium ochthodes*, Kunze. *A. tylodes*, Kunze; Christ in Bull. Herb. Boiss. vi. (1898) 967. *Nephrodium multijugum*, Bak.—Kweichau: Yunnan: Korea.

OLDHAMI, C. Chr. *Polypodium Oldhami*, Bak.; Hook. & Bak., Syn. Fil. ed. ii. 311.—Formosa.

OLIGOPHLEBIA, C. Chr. *Nephrodium oligophlebium*, Bak. *Aspidium oligophlebium*, Christ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 580.—Formosa: Korea.

OMEIENSIS, C. Chr. *Polypodium omeiense*, Bak. in Journ. Bot. xxvii. (1889) 229.—Szechuen.

OPACA, C. Chr. *Hemionitis opaca*, D. Don. *Athyrium opacum*, Copel. in Philipp. Journ. Sc. iii. v. 279. *Gymnogramme opaca*, Spreng.—Kwangtung.

OREOPTERIS, Maxon. *Polypodium Oreopteris*, Ehrh. *Dryopteris montana*, Christ in Bull. Acad. Géogr. Bot. xviii. (1909) 150.—Quelpart I.

ORNATA, C. Chr., Ind. Fil. 1905, 281. *Polypodium ornatum*, Wall. *Nephrodium tenericaule*, Hook.—China, South.

OSHIMENSIS, C. Chr. *Aspidium oshimense*, Christ in Bull. Herb. Boiss. sér. 2, i. (1901) 1018.—Loochoo.

OTARIOIDES, C. Chr. *Aspidium otarioides*, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 247.—Kweichau.

OYAMENSIS, C. Chr. *Polypodium oyamense*, Bak. *P. Krameri*, Franch. et Savat.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 37.—Szechuen.

PANDIFORMIS, C. Chr. *Aspidium pandiforme*, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 255.—Kweichau: Szechuen.

PARASITICA, O. Kuntze. *Polypodium parasiticum*, Linn. *Aspidium molle*, Sw.; Benth., Fl. Hongk. (1861) 455.—China, South: Formosa: Korea.

Var. LATIPINNA, O. Kuntze. *Nephrodium latipinna*, Hook.; Hook. & Bak., Syn. Fil. ed. ii. 292.—Hongkong: Kwangtung: Fokien.

PARATHELYPTERIS, C. Chr. *Aspidium parathelypteris*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 36.—Kweichau.

PATENS, O. Kuntze. *Aspidium patens*, Sw.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 581.—China: Formosa.

Var. PILOSUM, Christ in Bull. Herb. Boiss. sér. 2, iv. (1904) 615.—Formosa.

PELLUCIDA, C. Chr. *Aspidium pellucidum*, Franch. *Nephrodium pellucidum*, Diels in Engl. Jahrb. xxix. (1900) 191.—Yunnan.

PENANGIANA, C. Chr. *Polypodium penangiana*, Hook. *Nephrodium costatum*, Bedd.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 34. *Polypodium lineatum*, Colebr.—Kwangtung: Hupeh.

DRYOPTERIS PENNIGERA, C. Chr. *Polypodium pennigerum*, Forst. *Aspidium pennigerum*, Sw.; Christ in Bull. Herb. Boiss. vii. (1899) 17.—Yunnan.

PEREGRINA, C. Chr. *Nephrodium regulare*, Bak. in Journ. Bot. xiii. (1875) 200.—Kiangsi.

PHEGOPTERIS, C. Chr. *Polypodium Phegopteris*, Linn. *Nephrodium Phegopteris*, Prantl ; Kom. in Act. Hort. Petrop. xx. (1901) 117.—Manchuria : Korea.

PODOPHYLLA, O. Kuntze. *Nephrodium podophyllum*, Hook. ; Hook. & Bak., Syn. Fil. ed. ii. 260.—Hongkong : China, South.

POLYLEPIS, C. Chr. *Aspidium polylepis*, Franch. et Savat. *Nephrodium polylepis*, Bak. ; Diels in Engl. Jahrb. xxix. (1900) 190.—Yunnan : Szechuen : Hupeh : Shensi.

PORPHYROPHLEBIA, C. Chr. *Aspidium porphyrophlebium*, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 117.—Kweichau.

PTERIDIFORMIS, Christ, *l. c.* xvii. (1907) 137.—Yunnan.

PTEROIDES, O. Kuntze. *Polypodium pteroides*, Retz. *Nephrodium pteroides*, J. Sm. ; Hook. & Bak. *l. c.* 289.—China.

PROLIFERA, C. Chr. *Hemionitis prolifera*, Retz. *Polypodium proliferum*, Presl ; Hook. & Bak. *l. c.* 315.—China, South.

PROLIXA, O. Kuntze. *Aspidium prolixum*, Wall. *Nephrodium prolixum*, Bak. in Journ. Bot. xiii. (1875) 201.—Hongkong : Kwangtung : Kiangsi.

PUNCTATA, C. Chr. *Polypodium punctatum*, Thunb. *Nephrodium punctatum*, Diels ; Kom. *l. c.* 127.—Kwangtung : Fokien : Manchuria : Korea.

Var. HENRYI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 61.—Hupeh.

QUELPARTENSIS, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 7.—Quelpart I.

RAMPANS, C. Chr. *Nephrodium rampans*, Bak. in Journ. Bot. xxvii. (1889) 177.—Hupeh : Yunnan.

REPENTULA, C. B. Clarke, MSS. ; Christ in Lecomte, Not. Syst. i. (1909) 39.—Hongkong : Yunnan : Kiangsu.

RHODOLEPIS, C. Chr. *Nephrodium rhodolepis*, C. B. Clarke. *Aspidium intermedium*, Blume ; Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 117.—Kwangtung : Kweichau : Yunnan : Szechuen : Hupeh : Fokien : Formosa.

ROBERTIANA, C. Chr. *Polypodium Robertianum*, Hoffm. *Nephrodium Robertianum*, Prantl ; Kom. *l. c.* 125.—Szechuen : Manchuria.

ROSTHORNII, C. Chr. *Nephrodium Rosthornii*, Diels in Engl. Jahrb. xxix. (1900) 190.—China, South.

RUFOSTRAMINEA, C. Chr. *Aspidium rufostramineum*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 36.—Kweichau.

DRYOPTERIS SABÆI, C. Chr. *Aspidium Sabæi,* Franch. et Savat.; Matsum., Ind. Pl. Japon. (1904) 385.—Loochoo.

SCALLANII, C. Chr. *Aspidium Scallanii,* Christ in Bull. Soc. Bot. Ital. x. (1901) 296.—Szechuen.

SETIGERA, O. Kuntze. *Cheilanthes setigera,* Blume. *Nephrodium setigerum,* Bak.; Hook. & Bak., Syn. Fl. ed. ii. 284. *Aspidium uliginosum,* Kunze. *Polypodium tenericaule,* Wall.—China: Formosa: Korea.

Var. CALVATUM, Bak. in Journ. Bot. xiii. (1875) 201.—Kiangsi.

SIEBOLDII, O. Kuntze. *Aspidium Sieboldii,* van Houtte; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 33.—Kweichau: Szechuen.

SIMPLEX, C. Chr. *Meniscium simplex,* Hook.; Benth., Fl. Hongk. (1861) 457.—Hongkong: Chusan: Formosa.

SINICA, Christ in Lecomte, Not. Syst. i. (1909) 28.—Yunnan.

SHEARERI, C. Chr. *Nephrodium Shearerì,* Bak. in Journ. Bot. xiii. (1875) 200.—Kiangsi.

SOPHOROIDES, O. Kuntze. *Nephrodium sophoroides,* Desv.; Hook. & Bak. *l. c.* 289.—China: Formosa: Korea.

SPARSA, O. Kuntze. *Nephrodium sparsum,* D. Don; Diels in Engl. Jahrb. xxix. (1900) 191.—Hongkong: Kwangtung: Kweichau: Yunnan: Fokien.

SPHÆROPTEROIDES, C. Chr. *Polypodium sphæropteroides,* Bak. in Kew Bull. 1898, 55.—Yunnan: Szechuen.

SPINULOSA, O. Kuntze. *Polypodium spinulosum,* Mühl. *Nephrodium spinulosum,* Strempel; Diels, *l. c.* 190. *Nephrodium dilatatum,* Desv.—Yunnan: Manchuria: Korea.

SPLENDENS, O. Kuntze. *Nephrodium splendens,* Hook.; Bak. in Journ. Bot. xxv. (1887) 171.—Hupeh.

SQUAMÆSTIPES, C. Chr., Ind. Fil. 1905, 294. *Polypodium appendiculatum,* var. *squamæstipes,* C. B. Clarke.—China, Centr.

STENOLEPIS, C. Chr. *Polypodium stenolepis,* Bak. in Kew Bull. 1898, 231. *Aspidium yunnanense,* Christ.—Yunnan.

SUBEXALTATA, C. Chr. *Aspidium subexaltatum,* Christ in Bull. Herb. Boiss. sér. 2, iv. (1904) 616.—Formosa.

SUBLACERA, Christ in Lecomte, Not. Syst. i. (1909) 43.—Yunnan.

SUBOBSCURA, C. Chr. *Phegopteris subobscura,* Christ in Bull. Herb. Boiss. vi. (1898) 836.—Yunnan.

SUBRAMOSA, Christ in Lecomte, Not. Syst. i. (1909) 42.—Shensi.

SUBSAGENOIDES, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 8.—Quelpart I.

SUBSPINULOSA, C. Chr. *Aspidium subspinulosum,* Christ in Bull. Herb. Boiss. sér. 2, ii. (1902) 829.—Korea.

SUBTHELYPTERIS, C. Chr. *Aspidium melanorhizum,* Christ in Bull. Soc. Bot. Ital. 1901, 295.—Szechuen.

DRYOPTERIS SUBTRIPINNATA, O. Kuntze. *Nephrodium chinense*, Bak.; Hook. & Bak., Syn. Fil. ed. ii. 278.—China : Korea.

TAIWANENSIS, C. Chr. *Aspidium lobulatum*, Christ in Bull. Herb. Boiss. sér. 2, iv. (1904) 614.—Formosa.

TAQUETII, Christ in Bull. Acad. Géogr. Bot. xviii. (1909) 152.—Quelpart I.

TENUICOLA, Matt. & Christ; Christ in Lecomte, Not. Syst. i. (1909) 56.—Kwangtung.

THELYPTERIS, A. Gray. *Nephrodium Thelypteris*, Desv.; Kom. in Act. Hort. Petrop. xx. (1901) 118.—China, North : Yunnan : Korea.

THIBETICA, C. Chr. *Nephrodium thibeticum*, Bak.; Diels in Engl. Jahrb. xxix. (1900) 189.—China, West.

TOKIOENSIS, C. Chr., Ind. Fil. 1905, 298. *Aspidium tokioense*, Matsum. *A. transitorium*, Christ.—Korea.

TRIPHYLLA, C. Chr. *Meniscium triphyllum*, Sw.; Hook. & Bak., Syn. Fil. ed. ii. 391.—China, South : Formosa.

TRUNCATA, O. Kuntze. *Polypodium truncatum*, Poir. *Nephrodium truncatum*, Presl; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 577.—Formosa.

UROPHYLLA, C. Chr. *Polypodium urophyllum*, Wall. *P. granulosum*, Benth., Fl. Hongk. (1861) 459. ? *Meniscium cuspidatum*, Blume.—Hongkong : China, South : Formosa : Loochoo.

VIRIDESCENS, O. Kuntze. *Nephrodium viridescens*, Bak.; Diels in Engl. Jahrb. xxix. (1900) 190.—Kweichau : Yunnan : Shensi : Korea : Loochoo.

XYLOIDES, Christ in Lecomte, Not. Syst. i. (1909) 41. *D. ochthodes*, var. *xyloides*, C. Chr.

YÆYAMENSIS, C. Chr. *Aspidium yæyamensis*, Mak. in Bot. Mag. Tokyo, xii. (1897) 18.—Loochoo.

ELAPHOGLOSSUM AUSTRO-SINICUM, Matt. & Christ; Christ in Lecomte, Not. Syst. i. (1909) 57.—Kwangtung.

FUSCO-PUNCTATUM, Christ in Bull. Herb. Boiss. vi. (1898) 867.—Yunnan.

PETIOLATUM, Urban. *Acrostichum petiolatum*, Sw. *Elaphoglossum viscosum*, Schott; Christ in Bull. Herb. Boiss. vi. (1898) 867.—Yunnan.

Var. YUNNANENSE, C. Chr. *Acrostichum yunnanense*, Bak. in Kew Bull. 1898, 233.—Yunnan.

GLEICHENIA GLAUCA, Hook.; Diels in Engl. Jahrb. xxix. (1900) 208. *Polypodium glaucum*, Thunb. *Gleichenia longissima*, Blume.—China, South : Formosa : Korea.

Var. ARACHNOIDES, C. Chr. *G. arachnoides*, Mett.; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 268.—Kweichau.

GLEICHENIA LÆVISSIMA, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 268. —Kweichau : Yunnan.

LINEARIS, C. B. Clarke ; Diels in Engl. Jahrb. xxix. (1900) 208. *Polypodium lineare*, Burm. *Gleichenia dichotoma*, Willd.—China, South and Centr.: Formosa : Korea.

Var. LONGICAUDA, Christ in Bull. Herb. Boiss. vii. (1899) 19.— Yunnan.

Gymnogramme Delavayi, *Bak.* = Gymnopteris Delavayi, *Underw.*
elliptica, *Bak.* = Polypodium ellipticum, *Thunb.*
fraxinea, *Bedd.* = Coniogramme fraxinea, *Diels.*
gigantea, *Bak.* = Diplazium latifolium, *Moore*, var. gigantea, *C. Chr.*
grammitoides, *Bak.* = Polypodium grammitoides, *Diels.*
Hamiltoniana, *Hook.* = Polypodium pedunculatum, *Mett.*
Henryi, *Bak.* = Polypodium Henryi, *Diels.*
involuta, *Hook.* = Polypodium scolopendrinum, *C. Chr.*
japonica, *Desv.* = Coniogramme japonica, *Diels.*
lanceolata, *Hook.* = Polypodium Loxogramme, *Mett.*
Maingayi, *Bak.* = Leptochilus Harlandii, *C. Chr.*, partly.
Makinoi, *Maxim.* = Anogramma Makinoi, *Christ.*
membranacea, *Hook.* = Polypodium Selliguea, *Mett.*
Totta, *Schlecht* = Dryopteris africana, *C. Chr.*
vestita, *Presl* = Gymnopteris vestita, *Underw.*

GYMNOPTERIS BIPINNATA, Christ in Lecomte, Not. Syst. i. (1909) 55.— Hupeh.

DELAVAYI, Underw. *Gymnogramme Delavayi*, Bak. *Neurogramme Delavayi*, Diels in Engl. Jahrb. xxix. (1900) 199.—Yunnan: Szechuen: Hupeh : Shensi.

VESTITA, Underw. *Grammitis vestita*, Wall. *Neurogramme vestita*, Diels, *l. c.*—Yunnan : Shensi.

HELMINTHOSTACHYS ZEYLANICA, Hook. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 558.—Formosa.

HEMIONITIS ARIFOLIA, Moore ; Matsum. & Hayat. *l. c.* 611.—Formosa.
Griffithi, *Hook. fil. & Thoms.* = Aspidium Griffithii, *Diels.*

HISTRIOPTERIS INCISA, J. Sm. *Pteris incisa*, Thunb. ; Hook. & Bak., Syn. Fil. ed. ii. 172.—Kwangtung : Kweichau : Formosa.

HUMATA Hookeri, *Diels* = Davallia Clarkii, *Bak.*

LEPIDA, Moore. *Davallia lepida*, Presl. *D. Cumingii*, Hook. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 589.—Formosa : Loochoo.

HUMATA REPENS, Diels. *Adiantum repens*, Linn. fil. *Davallia pedata*, Sm.; Benth., Fl. Hongk. (1861) 461.—China, South : Formosa.

TYERMANNI, Moore. *Davallia Tyermanni*, Bak. in Gard. Chron. n. s. xiv. (1880) 494.—Kiangsu : Kiangsi.

HYMENOLEPIS SPICATA, Presl; Christ in Bull. Herb. Boiss. vi. (1898) 956. *Acrostichum spicatum*, Linn. fil.—Yunnan.

HYMENOPHYLLUM AUSTRALE, Willd. *H. javanicum*, Spreng.; Diels in Engl. Jahrb. xxix. (1900) 187.—Kwangtung : Loochoo.

BARBATUM, Bak.; Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 107. *Leptocyonium barbatum*, v. d. Bosch.—Kiangsi : Kweichau : Yunnan : Szechuen : Hupeh : Formosa : Korea.

BLUMEANUM, Spreng. *H. integrum*, v. d. Bosch; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 101.—Szechuen.

CORRUGATUM, Christ in Bull. Herb. Boiss. sér. 2, iii. (1903) 508.—Hupeh.

Var. ELONGATUM, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 101.—Szechuen.

DELAVAYI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 11.—Yunnan.

DENTICULATUM, Sw.; Diels in Engl. Jahrb. xxix. (1900) 187.—Szechuen: Formosa.

DILATATUM, Sw., var. AMPLUM, Christ in Bull. Herb. Boiss. vii. (1899) 2.—Yunnan.

FASTIGIOSUM, Christ, *l. c.* 3.—Yunnan.

HENRYI, Bak. in Journ. Bot. xxvii. (1889) 176.—Hupeh.

integrum, *v. d. Bosch* = H. Blumeanum, *Spreng.*

javanicum, *Spreng.* = H. australe, *Willd.*

MICROSORUM, v. d. Bosch; C. Chr., Ind. Fil. 1905, 364.—China.

OLIGOSORUM, Mak.; C. Chr. *l. c.* 365.—Korea.

OMEIENSE, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 101.—Szechuen.

OXYODON, Bak. in Herb. Matthew, 1907.—Kwangtung.

PANICULIFLORUM, Presl; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 102.—Szechuen.

POLYANTHOS, Sw.; Diels in Engl. Jahrb. xxix. (1900) 187.—China, South : Formosa.

RIUKIUENSE, Christ in Ann. Cons. Jard. Bot. Genèv. iv. (1900) 203.—Loochoo.

TUNBRIDGENSE, Sm.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 569. *Trichomanes tunbridgense*, Linn.—Formosa.

HYPOLEPIS punctata, *Mett.* = Dryopteris punctata, *C. Chr.*
TENUIFOLIA, Bernh.; Diels in Engl. Jahrb. xxix. (1900) 200. *Lonchitis tenuifolia*, Forst.; *Cheilanthes pallida*, Blume.—Kweichau: Yunnan: Szechuen: Formosa: Korea.

LEPTOCHILUS BONII, C. Chr. *Gymnopteris Bonii*, Christ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 586.—Formosa.
CUSPIDATUS, C. Chr. ? *Nephrodium cuspidatum*, Presl. *Acrostichum repandum*, Blume; Benth., Fl. Hongk. (1861) 444.—China, South: Formosa: Loochoo.
DECURRENS, Blume. *Gymnopteris variabile*, Bedd.; Christ in Bull. Herb. Boiss. vi. (1898) 867.—Yunnan.
HARLANDII, C. Chr. *Acrostichum Harlandii*, Hook.; Hook. & Bak., Syn. Fil. ed. ii. 418. *Gymnogramme Maingayi*, Bak., partly.—Hongkong: Formosa.
HETEROCLITUS, C. Chr. *Acrostichum heteroclitum*, Presl. *Gymnopteris flagellifera*, Bedd.; Diels in Engl. Jahrb. xxix. (1900) 195.—China, South: Formosa.
LOMARIOIDES, Blume. *Lomagramme pteroides*, J. Sm. in Herb. Matthew, 1907.—Kwangtung.
VIRENS, C. Chr. *Acrostichum virens*, Wall.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 641.—Formosa.
ZEYLANICUS, C. Chr. *Ophioglossum zeylanicum*, van Houtte. *Gymnopteris quercifolia*, Bernh.; Matsum. & Hayat. *l. c.* 586.—Hongkong: Formosa.

LINDSAYA CULTRATA, Sw.; Christ in Bull. Herb. Boiss. vi. (1898) 972. *Adiantum cultratum*, Willd.—Kweichau: Yunnan: Szechuen: Formosa: Korea.
Var. JAPONICA, Hook.; Christ in Bull. Acad. Géogr. Bot. xviii. (1909) 159.—Quelpart I.
DAVALLIOIDES, Blume; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 596.—Formosa.
ORBICULATA, Mett. *Adiantum orbiculatum*, Lam. *Lindsaya flabellulata*, Dry.; Benth., Fl. Hongk. (1861) 445.—China, South: Formosa.
REPENS, Bedd.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 597. *Dicksonia repens*, Bory.—Formosa: Loochoo.

LOMARIA DECURRENS, Bak. in Kew Bull. 1906, 9.—Yunnan.
deflexa, *Bak.* = Blechnum Faberi, *C. Chr.*

LOXOGRAMME DUCLOUXII, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 140. —Yunnan.
lanceolata, *Presl* = Polypodium Loxogramme, *Mett.*

LYGODIUM CIRCINATUM, Sw.; Benth., Fl. Hongk. (1861) 441. *Ophioglossum circinatum*, Burm.—Hongkong: Kwangtung.

FLEXUOSUM, Sw.; Christ in Bull. Herb. Boiss. vi. (1898) 973. *Ophioglossum flexuosum*, Linn.—China, South.

JAPONICUM, Sw.; Benth., Fl. Hongk. (1861) 441. *Ophioglossum japonicum*, Thunb.—China: Formosa: Korea.

SCANDENS, Sw.; Benth. *l. c.* *Ophioglossum scandens*, Linn.—China, South: Formosa.

SUBAREOLATUM, Christ in Bull. Acad. Géogr. xvii. (1907) 151.—Kweichau.

MARSILEA QUADRIFOLIA, Linn.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 559.—Formosa.

MATTEUCCIA CAVALERIANA, C. Chr. *Struthiopteris Cavaleriana*, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 118.—Kweichau.

ORIENTALIS, Trevis. *Struthiopteris orientalis*, Hook.; Diels in Engl. Jahrb. xxix. (1900) 188.—Szechuen: Chekiang: Shensi: Korea.

Var. BREVIS, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 44.—Szechuen.

Var. INCISA, Christ, *l. c.*—Szechuen: Hupeh.

STRUTHIOPTERIS, Todaro. *Osmunda Struthiopteris*, Linn. *Struthiopteris germanica*, Willd.; Hook. & Bak., Syn. Fil. ed. ii. 46.—Hupeh: Shensi: Manchuria.

MENISCIUM, Schreb. = DRYOPTERIS, Adans.

MICROLEPIA HANCEI, Prantl. *Davallia polypodioides*, Benth., Fl. Hongk. (1861) 461.—Hongkong.

hirsuta, *Diels* = M. pilosella, *Moore*.

HOOKERIANA, Presl. *Davallia Hookeriana*, Wall.; Benth. *l. c.* 461.—China, South: Formosa.

marginalis, *Bedd.* = M. marginata, *C. Chr.*

MARGINATA, C. Chr. *Polypodium marginatum*, van Houtte. *Microlepia marginalis*, Bedd.; Diels in Engl. Jahrb. xxix. (1900) 195.—China, South: Formosa.

MATTHEWII, Christ in Lecomte, Not. Syst. i. (1909) 54.—Kwangtung.

OBTUSILOBA, Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 27.—Formosa.

PILOSELLA, Moore. *Davallia pilosella*, Hook. *Microlepia hirsuta*, Diels, *l. c.* 196.—China, Centr. and North: Manchuria.

PINNATA, J. Sm., var. GRACILIS, Bak.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 592.—Formosa.

MICROLEPIA PLATYPHYLLA, J. Sm.; Christ in Bull. Herb. Boiss. vi. (1898) 972. *Davallia platyphylla*, D. Don.—Yunnan : Kweichau.

SPELUNCÆ, Moore. *Davallia Speluncæ*, Bak.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 591.—Formosa.

STRIGOSA, Presl; Diels in Engl. Jahrb. xxix. (1900) 196. *Trichomanes strigosa*, Thunb.—Kwangtung : Kweichau : Szechuen : Fokien : Formosa : Korea.

TENERA, Christ in Lecomte, Not. Syst. i. (1909) 53.—Yunnan : Kwangtung.

TRAPEZIFORMIS, Kuhn. *Davallia trapeziformis*, Roxb. *Microlepia rhomboidea*, Presl; Christ in Bull. Herb. Boiss. vi. (1898) 971.—Yunnan : Formosa.

WILFORDII, Moore; Diels, *l. c.* 195.—China, Centr. and North : Manchuria : Korea.

Var. CONTRACTA, Christ in Nuov. Giorn. Bol. Ital. 1907, 87.—Shensi.

MONACHOSORUM HENRYI, Christ in Bull. Herb. Boiss. vi. (1898) 869.—Yunnan : Kweichau.

Var. MICROPHYLLUM, Christ in Bull. Herb. Boiss. xiii. 110.

SUBDIGITATUM, Kuhn; Christ in Bull. Herb. Boiss. vi. (1898) 868. *Aspidium subdigitatum*, Blume.—Yunnan : Formosa.

MONOGRAMMA PARADOXA, Bedd.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 625.—Formosa.

ROBUSTA, C. Chr. *Pleurogramme robusta*, Christ in Bull. Herb. Boiss. vi. (1898) 867.—Yunnan : Szechuen.

NEOCHEIROPTERIS PALMATOPEDATA, Christ. *Polypodium palmatopedatum*, Bak. in Kew Bull. 1898, 232. *Cheiropteris Henryi*, Christ.—Yunnan.

NEPHRODIUM CLAVIVENIUM, Yabe; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 573.—Loochoo.

cyclodioides, *Bak.* = Dryopteris Bodinieri, *C. Chr.*

Fordii, *Bak.* = Dryopteris crenata, *O. Kuntze.*

intermedium, *Bak.* = Dryopteris rhodolepis, *C. Chr.*

LICHIANGENSE, C. H. Wright in Kew Bull. 1909, 267.—Yunnan.

MICROLEPIS, Bak. in Kew Bull. 1906, 110.—Yunnan.

MORSII, Bak. in Kew Bull. 1906, 11.—Kiangsi.

odoratum, *Bak.* = Dryopteris crenata, *O. Kuntze.*

patentissimum, *Clarke* = Dryopteris Filix mas, var. patentissimum, *C. Chr.*

puberulum, *Bak.* = Dryopteris Macarthyi, *C. Chr.*

regulare, *Bak.* = Dryopteris peregrina, *C. Chr.*

NEPHRODIUM SUBELATUM, Bak. in Kew Bull. 1906, 11.—Yunnan.
  UNIFURCATUM, Bak. in Journ. Bot. xxvi. (1888) 228.—Szechuen.
  YUNNANENSE, Bak. in Kew Bull. 1906, 11. *Aspidium yunnanense*, Christ.—Yunnan.

NEPHROLEPIS BISERRATA, Schott. *Aspidium biserratum*, Sw.; Benth., Fl. Hongk. (1861) 453. *Nephrolepis acuta*, Presl.—China, South: Formosa.
  CORDIFOLIA, Presl. *Polypodium cordifolium*, Linn. *Nephrolepis tuberosa*, Presl; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 265.—China, South: Formosa: Loochoo.
  EXALTATA, Schott. *Polypodium exaltatum*, Linn. *Aspidium exaltatum*, Sw.; Benth. *l. c.* 453.—China, South: Formosa: Loochoo.
  HIRSUTULA, Presl. *Polypodium hirsutulum*, Forst. *Aspidium hirsutulum*, Sw.; Benth. *l. c.* 453.—Hongkong.
  KUROIWÆ, Mak. in Bot. Mag. Tokyo, ix. (1895) 6.—Loochoo.
  ramosa, *Moore* = Arthropteris obliterata, *J. Sm.*

NEURODIUM, Fée = PALTONIUM, Presl.

NOTHOLÆNA BUREAUI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 59.—Yunnan.
  CHINENSIS, Bak. in Gard. Chron. n. s. xiv. (1880) 494.—Hupeh.
  HIRSUTA, Desv. *Pteris hirsuta*, Poir. *Nothoclæna sulcata*, Link; Benth., Fl. Hongk. (1861) 449.—China, South.
  MARANTÆ, R. Br.; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 134. *Acrostichum Marantæ*, Linn. *Gymnogramme Marantæ*, Mett.—Yunnan: Szechuen.

ODONTOSORIA CHINENSIS, J. Sm.; Seemann, Bot. Voy. 'Herald' (1857) 430. *Trichomanes chinensis*, Linn. *Davallia chinensis*, Sm. *D. tenuifolia*, Sw.; Benth., Fl. Hongk. (1861) 462.—China: Formosa.

OLEANDRA CUMINGII, J. Sm.; Hook. & Bak., Syn. Fil. ed. ii. 303.—Hongkong: Kwangtung.
  WALLICHII, Presl; Christ in Bull. Herb. Boiss. vi. (1898) 969. *Aspidium Wallichii*, Hook.—Yunnan.
    Var. LEPIDOTA, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 140.—Szechuen.

ONOCLEA SENSIBILIS, Linn.; Hook. & Bak., Syn. Fil. ed. ii. 46.—Manchuria: Korea.

ONYCHIUM CRYPTOGRAMMOIDES, Christ in Lecomte, Not. Syst. i. (1909) 52.—Yunnan.

JAPONICUM, Kunze ; Hook. & Bak., Syn. Fil. ed. ii. 143. *Trichomanes japonicum*, Thunb.—China : Formosa : Korea.

Var. DELAVAYI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 60.—Yunnan.

Var. LUCIDUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 60. *O. lucidum,* Spreng.

SILICULOSUM, C. Chr. *Pteris siliculosa,* Desv. *Onychium auratum,* Kaulf. ; Christ in Bull. Soc. Acad. Géogr. Bot. xvii. (1907) 130.—Yunnan: Formosa.

OPHIOGLOSSUM BRAUNII, Prantl ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 68.—Yunnan.

JAPONICUM, Prantl ; Diels in Engl. Jahrb. xxix. (1900) 209.—Hupeh.

NUDICAULE, Linn. fil. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 557.—Hongkong : Formosa.

PENDULUM, Linn. ; Christ in Bull. Herb. Boiss. vi. (1898) 973.—Yunnan : Formosa ; Loochoo.

RETICULATUM, Linn. ; Bak. in Journ. Bot. 1889, 178.—Hupeh : Yunnan : Szechuen : Korea.

VULGATUM, Linn. ; Kom. in Act. Hort. Petrop. xx. (1901) 152.—Manchuria.

OSMUNDA BANKSIIFOLIA, Kuhn ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 560. *Nephrodium banksiifolium,* Presl. *Osmunda javanica,* Hook. & Bak., partly.—Fokien : Formosa.

CINNAMOMEA, Linn. ; Kom. in Act. Hort. Petrop. xx. (1901) 149.—Kweichau : Yunnan : Fokien : Manchuria.

CLAYTONIANA, Linn. ; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 140.—Szechuen : Yunnan.

JAVANICA, Blume ; Benth., Fl. Hongk. (1861) 441.—China, South : Loochoo.

MILDEI, C. Chr. *O. bipinnata,* Hook. ; Benth. *l. c.* 440.—Hongkong : Kwangtung.

REGALIS, Linn. ; Benth. *l. c.*—China : Korea.

Var. JAPONICA, Bak. ; Christ in Bull. Herb. Boiss. vi. (1898) 973. *O. japonica,* Thunb.—Kweichau : Yunnan : Hupeh : Shensi.

Var. SUBLANCEA, Christ in Bull. Acad. Géogr. Bot. xviii. (1909) 160.—Korea.

VACHELLII, Hook. ; C. Chr., Ind. Fil. (1906) 475. *O. javanica,* Bak.—China, Centr.

Paltonium sinense, C. Chr. *Neurodium sinense*, Christ in Bull. Herb. Boiss. vi. (1898) 880.—Yunnan : Hupeh.

Pellæa Fauriei, Christ in Bull. Herb. Boiss. sér. 2, iv. (1904) 612.—Formosa.

geraniifolia, *Fée*=Doryopteris concolor, *Kuhn*.

hastata, Prantl ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 57. *Pteris hastata*, Thunb.—Yunnan.

Henryi, Christ in Bull. Herb. Boiss. vii. (1899) 7. ? *Pteris nitidula*, Bak.—Kweichau : Yunnan : Szechuen.

nitidula, Bak. ; Diels in Engl. Jahrb. xxix. (1900) 199. *Pteris nitidula*, Wall.—Kwangtung : Kweichau : Yunnan : Fokien : Hupeh.

Peranema cyatheoides, D. Don ; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 121.—Szechuen.

Phyllitis Delavayi, C. Chr. *Scolopendrium Delavayi*, Franchet in Bull. Soc. Bot. France, xxxii. (1885) 28 ; *cf.* Christ in lii. Mém. i. (1905) 52.—Yunnan : Szechuen.

Plagiogyria adnata, Bedd. ; Diels in Engl. Jahrb. xxix. (1900) 200. *Lomaria adnata*, Blume.—Kweichau : Yunnan : Szechuen : Loochoo.

Var. condensata, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 64.—Yunnan.

argutissima, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 140.—Kweichau.

assurgens, Christ in Bull. Soc. Bot. Ital. 1901, 293.—Szechuen.

Dunnii, Copel. in Philipp. Journ. Sc. iii. v. (1908) 281.—Fokien.

euphlebia, Mett. *Lomaria euphlebia*, Kunze ; Bak. in Journ. Bot. xiii. (1875) 200.—Kiangsi : Kweichau : Yunnan : Loochoo.

glauca, Mett. ; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 138. *Lomaria glauca*, Blume.—Yunnan : Formosa.

Var. philippensis, Christ ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 615.—Formosa.

Hayatana, Mak. in Bot. Mag. Tokyo, xxiii. (1909) 245.—Formosa.

Henryi, Christ in Bull. Herb. Boiss. vii. (1899) 8.—Yunnan.

Matsumureana, Mak. in Journ. Coll. Sc. Tokyo, xxv. (1908) 244.—Formosa.

pycnophylla, Mett. ; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 232. *Lomaria pycnophylla*, Kunze.—Kweichau : Yunnan.

stenoptera, Diels in Engl. & Prantl, Pflanzenfam. I. iv. (1899) 282.—Kweichau : Formosa.

tenuifolia, Copel. in Philipp. Journ. Sc. iii. v. (1908) 281. *P. Mathewii*, Christ, MS.—Kwangtung.

POLYBOTRIA APPENDICULATA, J. Sm.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 585. *Acrostichum appendiculatum*, Willd.—Hongkong: China, South: Formosa.

SINENSE, Bak. in Kew Bull. 1906, 14.—Yunnan.

POLYPODIUM alcicorne, *Bak.*=Polystichum alcicorne, *Diels.*

AMŒNUM, Wall.; Diels in Engl. Jahrb. xxix. (1900) 203.—China, South and West: Shensi: Formosa: Korea.

Var. LATEDELTOIDEUM, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 141.—Kweichau.

ANCEPS, C. Chr. *Selliguea anceps*, Christ in Bull. Herb. Boiss. vi. (1898) 879.—Yunnan.

angustissimum, *Bak.*=Cyclophorus tænoides, *C. Chr.*

APPENDICULATUM, Wall.; Bak. in Journ. Bot. xxv. (1887), 171. ? *Dryopteris cana*, O. Kuntze.—Hupeh.

ARENARIUM, Bak. in Kew Bull. 1895, 56.—Yunnan.

ASPIDIOLEPIS, Bak. in Ann. Bot. v. (1891) 474. *P. excavatum*, var. *aspidiolepis*, C. Chr.—Szechuen.

ASTEROLEPIS, Bak. in Journ. Bot. xxvi. (1888) 230. *Polypodium excavatum*, var. *asterolepis*, C. Chr.—Yunnan.

AUSTROSINICUM, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 107. *P. Henryi*, Christ.—Szechuen: Kweichau: Yunnan.

BODINIERI, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 203.—Kweichau.

braineoides, *Bak.*=Dryopteris braineoides, *C. Chr.*

BUERGERIANUM, Miq. *P. brachylepis*, Bak. in Gard. Chron. n. s. xiv. (1880) 494.—Kiangsi: Formosa.

CANTONIENSE, Bak. in Journ. Bot. xviii. (1879) 304. *Gymnogramme cantoniense*, Bak.—Kwangtung.

CAUDICEPS, Bak.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 628. *Goniophlebium caudiceps*, Moore.—Formosa.

CHINENSE, Mett.; Kuhn in Journ. Bot. vi. (1868) 270. *Polypodium sinense*, Christ.—Yunnan: Szechuen: Formosa.

CLATHRATUM, C. B. Clarke; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 209.—Kweichau.

CONNATUM, Christ, *l. c.* xvii. (1907) 141.—Kweichau.

CONVOLUTUM, Bak. in Kew Bull. 1906, 12.—Yunnan.

CORAIENSE, Christ, *l. c.* xviii. (1909) 147.—Quelpart I.

CORONANS, Wall.; Benth., Fl. Hongk. (1861) 459. *Polypodium conjugatum*, Bak. *Drynaria conjugata*, Bedd.—China, South: Formosa.

CRENATO-PINNATUM, C. B. Clarke in Journ. Linn. Soc., Bot. xxv. (1888) 99.—Yunnan.

POLYPODIUM CRINITUM, Bak. in Kew Bull. 1906, 12.—Yunnan.

CUCULATUM, Nees; Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 77.—Formosa.

CYCLOPHYLLUM, Bak. in Ann. Bot. v. (1891) 473.—Chekiang.

CYRTOLOBUM, C. B. Clarke in Trans. Linn. Soc. ser. 2. Bot. i. (1880) 563.—Yunnan.

DACTYLINUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 20.—Yunnan.

Davidii, *Bak.*=Cyclophorus pekinensis, *C. Chr.*

deltoideum, *Bak.*=P. hemitomum, *Hance.*

DIELSIANUM, C. Chr. *P. leuconeurum*, Diels in Engl. Jahrb. xxix. (1900) 203 (non Christ).

DIGITATUM, C. Chr. *Gymnogramme digitata*, Bak. *Selliguea Finlaysoniana*, Moore; Christ in Bull. Herb. Boiss. vi. (1898) 879.—Yunnan.

dilatatum, *Wall.*=P. europhyllum, *C. Chr.*

distans, *Don*=Dryopteris brunnea, *C. Chr.*

DIVARICATUM, Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 78.—Formosa.

DOLICHOPODUM, Diels in Engl. Bot. Jahrb. xxix. (1900) 205.—Szechuen.

DORSIPILUM, Christ in Warb. Monsunia, i. (1900) 59.—China, South.

DRYMOGLOSSOIDES, Bak. in Journ. Bot. xxv. (1887), 170.—Kweichau: Szechuen: Hupeh: Chusan: Kiangsu: Shensi.

Dryopteris, *Linn.*=Dryopteris Linneana, *C. Chr.*

DUCLOUXII, Christ in Lecomte, Not. Syst. i. (1909) 34.—Yunnan.

EBENIPES, Hook.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 17.—Yunnan.

EILOPHYLLUM, Diels. *Polypodium involutum*, Bak. in Journ. Bot. xxvii. (1889) 177.—Hupeh: Kweichau: Szechuen.

ELLIPTICUM, Thunb. *Grammitis decurrens*, Wall.; Benth., Fl. Hongk. (1861) 457. *Gymnogramme elliptica*, Bak.—Kwangtung: Szechuen: Hupeh: Formosa.

ENSATUM, Thunb.; Diels in Engl. Jahrb. xxix. (1900) 203.—Kweichau: Yunnan: Szechuen: Hupeh: Formosa.

ERYTHROCARPUM, Mett.; Diels, *l. c.* *Goniophlebium erythrccarpum*, Bedd.—Szechuen.

EUROPHYLLUM, C. Chr. *P. dilatatum*, Wall.; Diels, *l. c.* 205.—Hongkong: Kwangtung: Kweichau: Yunnan.

EXCAVATUM, Bory. *P. simplex*, Sw.; Christ in Bull. Herb. Boiss. vi. (1898) 875.—Yunnan: Szechuen: Hupeh.

FABERI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 17.—Szechuen.

fissum, *Bak.*=Cyclophorus porosus, *Presl.*

POLYPODIUM FLEXILOBUM, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 107. *Selliguea elliptica*, var. *flagellaris*, Christ.—Kweichau.

FORMOSANUM, Bak. in Journ. Bot. xxiii. (1885) 105.—Formosa.

FUSCO-NIGRUM, Bak. in Kew Bull. 1905, 55.—Yunnan.

GLAUCOPSIS, Franchet in Bull. Soc. Bot. France, xxxii. (1885) 29.—Yunnan.

GRAMMITOIDES, Diels. *Gymnogramme grammitoides*, Bak. in Journ. Bot. xxvii. (1889) 178.—Yunnan: Hupeh.

GRIFFITHIANUM, Hook.; Christ in Bull. Herb. Boiss. vi. (1898) 875.—Yunnan: Szechuen.

GRISEO-NIGRUM, Bak. in Kew Bull. 1895, 55.—Yunnan.

gymnogrammoides, *Bak.* = Dryopteris gymnogrammoides, *C. Chr.*

HAINANENSE, C. Chr. *P. dimorphum*, Bak. in Ann. Bot. v. (1891) 477.—Formosa: Hainan: ? Kwangtung.

HANCOCKII, Bak. in Journ. Bot. xxiii. (1885) 106.—Formosa.

HASTATUM, Thunb.; Diels in Engl. Jahrb. xxix. (1900) 205. *P. trifidum*, D. Don.—Yunnan: Szechuen: Fokien: Shensi: Formosa: Korea.

Forma PYGMÆA, Maxim., Fl. As. Or. Fragm. 73. *P. Mathewii*, Tutcher.—Wei-hai-Wei.

Var. ALBOPUNCTATUM, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 139.—Yunnan.

Var. CATADROMUM, Christ in Lecomte, Not. Syst. i. (1909) 33.—China, West.

Var. ENGLERI, Christ in Bull. Herb. Boiss. vi. (1898) 875. *P. Engleri*, Luerss.—Yunnan: Quelpart I.

Var. SIMPLEX, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 105.—Szechuen.

HEDERACEUM, Christ, *l. c.* xi. (1902) 215.—Kweichau.

HEMIONITIDEUM, Wall.; C. Chr., Ind. Fil. (1906) 532.—Hongkong: Kwangtung: Formosa.

HEMITOMUM, Hance in Journ. Bot. xxi. (1883) 269. *P. deltoideum*, Bak. (non Sw.). *P. phyllomanes*, var. *hemitomum*, Christ.—Hupeh.

Henryi, *Christ* = P. austrosinicum, *Christ.*

HENRYI, Diels. *Gymnogramme Henryi*, Bak. in Journ. Bot. xxv. (1887) 171. *Selliguea Henryi*, Christ.—Szechuen: Hupeh.

HIMALAYENSE, Hook.; Bak. *l. c.* xxvi. (1888) 230. *P. venustum*, Wall.—Kweichau: Yunnan: Szechuen.

HIRTELLUM, Blume; C. Chr., Ind. Fil. (1906) 533.—Kwangtung.

INTRAMARGINALE, Bak. in Kew Bull. 1906, 13.—Hupeh: Yunnan.

involutum, *Bak.* = P. eilophyllum, *Diels.*

irioides, *Poir.* = P. punctatum, *Sw.*

juglandifolium, *D. Don* = P. Wallichianum, *Spreng.*

KAWAKAMII, Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 77.—Formosa.

POLYPODIUM Krameri, *Franch. et Savat.*=Dryopteris oyamensis, *C. Chr.*

LEHMANNI, Mett.; Christ in Bull. Herb. Boiss. vi. (1898) 876.—Yunnan : Szechuen : Formosa.

LEIORHIZON, Wall.; Christ, *l. c.*—Kweichau : Yunnan.

leuconeurum, *Diels*=P. Dielsianum, *C. Chr.*

LEWISII, Bak. in Journ. Bot. xiii. (1875) 201.—Yunnan : Szechuen : Shensi : Kiangsi.

LINEARE, Thunb. *P. Wightianum*, Wall.; Benth., Fl. Hongk. (1861) 458.—China : Manchuria : Formosa : Korea.

Var. ABBREVIATUM, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 208.—Kweichau : Yunnan : Szechuen.

Var. CONTORTUM, Christ in Nuov. Giorn. Bot. Ital. iv. (1897) 98.—Kweichau : Shensi : Quelpart I.

Var. GLAUCOSORUM, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 209.—Yunnan.

Var. ONOEI, Mak.; Matsum., Ind. Pl. Japon. (1904) 336. *P. Onoei*, Franch. et Savat.—Loochoo : Quelpart I.

LIUKIUENSE, Christ in Bull. Herb. Boiss. sér. 2, ii. (1901) 1014.—Loochoo.

LOMARIOIDES, Kunze; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 633. *Drynaria lomarioides*, J. Sm.—Formosa.

LONGISSIMUM, Blume; Matsum. & Hayat. *l. c.* 632.—Kwangtung : Formosa : Loochoo.

LOXOGRAMME, Mett.; Diels in Engl. Jahrb. xxix. (1900) 204. *Gymnogramme lanceolata*, Hook.—Fokien : Hupeh : Formosa : Korea.

MACROPHYLLUM, Reinw. *Gymnogramme macrophyllum*, Hook.; Bak. in Journ. Bot. xxvi. (1888) 230. *Selliguea macrophyllum*, Blume.—Szechuen.

macrosorum, *Bak.*=P. megasorum, *C. Chr.*

MACROSPHÆRUM, Bak. in Kew Bull. 1895, 55.—Kweichau : Yunnan : Szechuen.

MACULOSUM, Christ in Bull. Herb. Boiss. vi. (1898) 872.—Yunnan : Szechuen.

Maingayi, *Diels*. Gymnogramme Maingayi, *Bak.*=Leptochilus Harlandii, *C. Chr.*, partly.

MALACODON, Hook.; Bak. in Journ. Bot. xxvii. (1889) 177.—Szechuen.

Var. STEWARTII, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 18. *P. Stewartii*, C. B. Clarke.—Szechuen.

MANMEINENSE, Christ in Bull. Herb. Boiss. vi. (1898) 870.—Yunnan : Szechuen.

Mathewii, *Tutcher*=P. hastatum, forma pygmæa, *Maxim.*

MEDIALE, Bak.; C. Chr., Ind. Fil. (1906) 543. *P. parasiticum*, Mett.—Kwangtung.

POLYPODIUM MEGASORUM, C. Chr. *P. macrosorum*, Bak. in Journ. Bot. xxiii. (1885) 106.—Formosa.

MEMBRANACEUM, D. Don; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 16.—Yunnan.

MENGTZEANUM, Bak. in Kew Bull. 1906, 14.—Yunnan.

MENGTZEENSE, Christ in Bull. Herb. Boiss. vi. (1898) 869. *P. aspersum*, Bak. *P. argutum*, var. *khasianum*, C. B. Clarke.—Yunnan.

MEYENIANUM, Hook.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii (1906) 634. *Aglaomorpha Meyeniana*, Schott.—Formosa.

MEYI, Christ in Lecomte, Not. Syst. i. (1909) 33.—Yunnan.

MICROPTERIS, Bak. in Kew Bull. 1906, 14.—Yunnan.

MICRORHIZOMA, C. B. Clarke; C. Chr., Ind. Fil. (1906) 545.—Yunnan.

mollissimum, *Christ*=Cyclophorus malacophyllus, *C. Chr.*

MORRISONENSE, Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 78.—Formosa.

MOUPINENSE, Franchet; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 105. *P. drymoglossoides*, var. *moupinense*, Christ.—Szechuen.

MYRIOCARPUM, Mett.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 634. *Phymatodes myriocarpa*, Presl.—Formosa.

NIGROCINCTUM, Christ in Bull. Herb. Boiss. vi. (1898) 874.—Yunnan.

NINGPOENSE, Bak. in Ann. Bot. v. (1891) 474. ? *P. superficiale*, Blume.—Chekiang.

NIPONICUM, Mett.; Diels in Engl. Bot. Jahrb. xxix. (1900) 203.—Yunnan: Fokien: Hupeh.

Var. LEVIPES, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 13.—Yunnan.

NORMALE, D. Don; Hook. & Bak., Syn. Fil. ed. ii. 358.—Hongkong: Kwangtung: Yunnan: Szechuen: Hupeh: Fokien: Formosa.

OBLIQUATUM, Blume; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 635.—Formosa.

OBLONGISORUM, C. Chr. *P. subintegrum*, Bak. in Kew Bull. 1898, 231.—Yunnan.

Oldhami, *Bak.*=Dryopteris Oldhami, *C. Chr.*

OLIGOLEPIDUM, Bak. in Gard. Chron. n.s. xiv. (1880) 494.—*P. lineare*, var. *oligolepidum*, Christ.—Kiangsi: Kwangtung: Kweichau: Yunnan: Hupeh: Shensi: Korea.

OLIGOLEPIS, Bak. in Kew Bull. 1898, 231.—Yunnan.

omeiense, *Bak.*=Dryopteris omeiensis, *C. Chr.*

ovatum, *Wall.*=P. phyllomanes, *Christ.*

oyamense, *Bak.*=Dryopteris oyamensis, *C. Chr.*

palmatopedatum, *Christ*=Neocheiropteris palmatopedata, *Christ.*

parasiticum, *Mett.*=P. mediale, Bak.

PEDUNCULATUM, Mett. *Ceterarch pedunculatum*, Hook. & Grev. *Selliguea Hamiltoni*, Presl; Christ in Bull. Soc. Bot. France, lii. Mém. i.

(1905) 21. *Gymnogramme Hamiltoniana*, Hook.—Kweichau : Yunnan : Szechuen.

POLYPODIUM PHYLLOMANES, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 210. *P. ovatum*, Wall.—Kweichau : Yunnan : Szechuen : Hupeh.

Var. DORYOPTERIS, Christ, *l. c.* 214.—Kweichau.

Var. hemitomum, *Christ*=P. hemitomum, *Hance*.

Var. POPULNEUM, Christ in Bull. Herb. Boiss. vi. (1898) 873.—Yunnan.

PHYMATODES, Linn.: C. Chr., Ind. Fil. (1906) 553.—Hongkong : China, South : Formosa : Loochoo.

PINNATUM, Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 79.—Formosa.

PLAYFAIRII, Bak. in Ann. Bot. v. (1891) 474.—Formosa.

PODOBASIS, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 215.—Yunnan : Szechuen.

PSEUDO-DIMIDIATUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 14.—Yunnan.

PSEUDO-SERRATUM, Christ in Bull. Herb. Boiss. vi. (1898) 871.—Yunnan.

PTEROPUS, Blume. *P. tridactylon*, Wall.; Benth., Fl. Hongk. (1861) 458.—Hongkong : Kwangtung : Formosa.

Var. RIU-KIUENSE, Christ in Ann. Conserv. Jard. Bot. Genèv. 1900, 270.—Loochoo.

PUNCTATUM, Sw. *Acrostichum punctatum*, Linn. *P. irioides*, Poir.; Diels in Engl. Jahrb. xxix. (1900) 203.—China, South and West : Formosa.

rheosorum, *Bak.*=Dryopteris lepidorachis, *C. Chr.*

ROSTHORNII, Diels, *l. c.* 205.—Szechuen.

ROSTRATUM, Hook.; Diels, *l. c.* 204. *P. subrostratum*, C. Chr.—Kwangtung : Yunnan : Hupeh : Kiangsu.

SAMPSONI, Bak. in Ann. Bot. v. (1891) 471.—Kwangtung.

SARCOPUS, de Vries & Teysm.; C. Chr., Ind. Fil. (1906) 561.—China, Centr.

SCALARE, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 14.—Yunnan.

SCOLOPENDRINUM, C. Chr. *Grammitis scolopendrina*, Bory. *Gymnogramme involuta*, Hook.; Bak. in Journ. Bot. xxvi. (1888) 230.—Yunnan : Szechuen : Hupeh.

SELLIGUEA, Mett. *Gymnogramme membranacea*, Hook.; Ford in Herb. Hongk.—Hongkong.

SHENSIENSE, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 99.—Shensi : Hupeh.

Var. NIGROVENIUM, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 106.—Szechuen.

POLYPODIUM SIKKIMENSE TRICHOMANOIDES, C. B. Clarke ; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 107.—Szechnen.

SILVESTRII, Christ in Lecomte, Not. Syst. i. (1909) 58.—Hupeh : Kweichau.

simplex, *Sw.*=P. excavatum, *Bory.*

SIMULANS, Bak. in Kew Bull. 1906, 13.—Yunnan.

sinicum, *Christ*=P. subfalcatum, *Blume.*

SINUOSUM, Wall. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 633.—Formosa.

SOULIEANUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 15.—Yunnan : Szechuen.

Steerii, *Harring.*=P. Playfairii, *Bak.*

stenopteron, *Bak.*=Dryopteris Dielsii, *C. Chr.*

SUBAMŒNUM, C. B. Clarke ; Christ in Nuov. Giorn. Bot. Ital. iv. (1897) 99.—China, South : Hupeh : Shensi.

Var. CHINENSE, Christ, *l. c.*—Shensi.

SUBAURICULATUM, Blume ; Christ in Bull. Herb. Boiss. vi. (1898) 870.—Yunnan : Formosa.

SUBFALCATUM, Blume ; C. Chr., Ind. Fil. (1906) 567.—Yunnan.

SUBHASTATUM, Bak. in. Journ. Bot. xxvii. (1889) 177.—Hupeh.

SUBHEMIONITIDEUM, Christ in Bull. Herb. Boiss. vii. (1899) 5.—Yunnan.

SUBIMMERSUM, Bak. in Kew Bull. 1895, 55.—Yunnan.

subintegrum, *Bak.*=P. oblongisorum, *C. Chr.*

SUBROSTRATUM, C. Chr., Ind. Fil. (1906) 567.—China, Centr.

SUPERFICIALE, Blume. *P. hymenodes*, Kunze ; Benth., Fl. Hongk. (1861) 458.—Hongkong : Kweichau : Szechuen : Hupeh : Formosa : Korea.

TAIWANIANUM, Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 80.—Formosa.

TALIENSE, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 13.—Yunnan.

TATSIENSE, Franch. et Bureau ; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1909) 19.—Szechuen.

TONQUINENSE, Bak. ; Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 141.—Kweichau.

TRABECULATUM, Copel. in Philipp. Journ. Sc. iii. v. (1908) 283. ? *P. oligolepidum*, Bak.—Kwangtung.

TRICHOPHYLLUM, Bak. in Kew Bull. 1906, 13.—Yunnan.

trifidum, *D. Don*=P. hastatum, *Thunb.*

TRIGLOSSUM, Bak. in Kew Bull. 1898, 232. *Selliguea triphylla*, Christ.—Yunnan.

TRISECTUM, Bak. in Kew Bull. 1898, 232.—Yunnan.

UDUM, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 140.—Kweichau.

VALDEALATUM, Christ in Bull. Herb. Boiss. vii. (1899) 4.—Yunnan.

VEITCHII, Bak. ; Christ in Bull. Acad. Géogr. Bot. xix. (1910) 9.—Korea.

POLYPODIUM VULGARE, Linn.; Diels in Engl. Jahrb. xxix. (1900) 203.—China, West : Manchuria.

Var. JAPONICUM, Franch. & Savat. *P. Fauriei*, Christ in Bull. Herb. Boiss. iv. (1896) 672.—Quelpart I.

WALLICHIANUM, Spreng. *P. juglandifolium*, D. Don; Christ in Bull. Herb. Boiss. vi. (1898) 876.—Yunnan.

WILSONI, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 104.—Szechuen.

WRIGHTII, Mett. *Gymnogramme Wrightii*, Hook.; Hook. & Bak., Syn. Fil. ed. ii. 388.—Kwangtung : Formosa : Loochoo.

XIPHIOPTERIS, Bak. in Kew Bull. 1906, 13.—Yunnan.

YAKUSHIMÆ, Christ in Bull. Herb. Boiss. sér. 2, i. (1901) 1014. *Gymnogramme lanceolata*, var. *minor*, Bak. *Loxogramme minor*, Mak.—Loochoo.

YUNNANENSE, Franch. in Bull. Soc. Bot. France, xxxii. (1885) 29.—Yunnan.

POLYSTICHUM ACANTHOPHYLLUM, Christ. *Aspidium acanthophyllum*, Franch. in Bull. Soc. Bot. France, xxxii. (1885) 28.—Yunnan : Szechuen : Shensi.

Var. INDICUM, Hope; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 112.—Yunnan : Szechuen.

ACULEATUM, Roth; Diels in Engl. Jahrb. xxix. (1900) 193. *Polypodium aculeatum*, Linn.—China : Formosa.

Var. ANGULARE, Bak. in Journ. Bot. xxvi. (1888) 227. *Aspidium angulare*, Willd.—Szechuen : Hupeh.

Var. BIARISTATUM, Bak. *l. c.* *Aspidium biaristatum*, Blume.—Szechuen.

Var. CORAIENSE, Christ in Bull. Acad. Géogr. Bot xviii. (1909) 9.—Quelpart I.

Var. FARGESII, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 29.—Yunnan : Szechuen.

Var. OBTUSUM, Mett.; Matsum. & Hayat. in Journ. Coll. Sc, Tokyo, xxii. (1906) 581.—Formosa.

Var. PLATYLEPIS, Diels in Engl. Jahrb. xxix. (1900) 194.—China, Centr.

Var. PYCNOPTERUM, Christ in Bull. Herb. Boiss. vii. (1899) 14.—Yunnan.

Var. VEITCHII, Christ, *l. c.* sér. 2, iii. (1903) 513.—Hupeh.

Var. YUNNANENSE, Christ, *l. c.* vi. (1898) 964.—Yunnan.

ACUTIDENS, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 259.—Kweichau.

affine, *Presl* = P. speciosum, *J. Sm.*

POLYSTICHUM ALCICORNE, Diels. *Polypodium alcicorne*, Bak. in Journ. Bot. xxvi. (1888) 229.—Szechuen.

AMABILE, J. Sm. *Aspidium amabile*, Blume; Bak. in Journ. Bot. xiii. (1875) 200.—China, South : Kiangsi : Formosa : Korea.

ARISTATUM, Presl. *Polypodium aristatum*, Forst. *Aspidium aristatum*, Sw. ; Benth., Fl. Hongk. (1861) 456.—China : Formosa : Korea.

ATKINSONII, Bedd. *Aspidium Atkinsonii*, C. B. Clarke; Bak. in Journ. Bot. xxvii. (1889) 176.—Szechuen : Hupeh.

AURICULATUM, Presl ; Diels in Engl. Jahrb. xxix. (1900) 192. *Polypodium auriculatum*, Linn.—Kwangtung : Yunnan : Fokien : Formosa.

Var. STENOPHYLLUM, Bak. in Journ. Bot. xxvi. (1888) 227.—Szechuen.

Var. SUBMARGINALE, Bak. *l. c.*—Szechuen.

BAKERIANUM, Diels; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 113. *Aspidium Bakerianum*, Atkins.—Szechuen.

BASIPINNATUM, Diels. *Aspidium basipinnatum*, Bak. in Journ. Bot. xxvii. (1889) 176.—Hongkong : Kwangtung.

BRAUNII, Fée ; Diels in Engl. Jahrb. xxix. (1900) 194. *Aspidium Braunii*, Spenn.—China, North : Manchuria : Quelpart I.

Var. CLARKII, Christ in Bull. Herb. Boiss. vi. (1898) 15.—Kweichau : Yunnan.

cæspitosum, *Schott* = P. obliquum, *Moore*.

CAPILLIPES, Diels. *Aspidium capillipes*, Bak. in Journ. Bot. xxvi. (1888) 228.—Szechuen : Yunnan.

caruifolium, *Bak.* = P. omeiense, *C. Chr.*

CARVIFOLIUM, C. Chr. *Aspidium carvifolium*, Kunze. *Aspidium coniifolium*, Wall. *Polystichum Faberi*, Christ in Lecomte, Not. Syst. i. (1909) 37.—Kweichau : Yunnan : Szechuen : Hupeh : Formosa.

coniifolium, *Wall.* = P. carvifolium, *C. Chr.*

CRASPEDOSORUM, Diels in Engl. Jahrb. xxix. (1900) 192. *Aspidium craspedosorum*, Maxim.—Kweichau : Hupeh : Shensi : Manchuria : Korea.

Var. GIRALDII, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 93 —Shensi.

DELTODON, Diels. *Aspidium deltodon*, Bak. in Gard. Chron. n. s. xiv. (1880) 494.—Kwangtung : Kweichau : Yunnan: Szechuen : Formosa.

Var. CULTRATA, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 27 —Yunnan.

Var. HENRYI, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 109.—Yunnan : Szechuen.

DIPLAZIOIDES, Christ, *l. c.* xi. (1902) 260.—Kweichau.

FALCATUM, Diels in Engl. Jahrb. xxix. (1900) 194. *Polypodium falcatum*, Linn. fil. *Cyrtomium falcatum*, Presl.—China : Formosa : Korea.

POLYSTICHUM FALCATUM.

Forma ACUMINATUM, Diels in Engl. Jahrb. xxix. (1900) 195.—China, Centr.: Quelpart I.

Forma INTERMEDIUM, Diels, *l. c.*—China, Centr.: Quelpart I.

Forma MACROPTERUM, Diels, *l. c.*—China, Centr.

Forma POLYPTERUM, Diels, *l. c.*—China, Centr.

Var. CARYOTIDEUM, Wall.; Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 116.—Kweichau: Szechuen: Hupeh: Shensi: Formosa.

Var. GENUINA, Mak. in Bot. Mag. Tokyo, 1906, 212.—Formosa.

Var. MUTICUM, Christ in Lecomte, Not. Syst. i. (1909) 37.—Yunnan.

FALCINELLUM. *Cyrtomium falcinellum*, Christ in Nuov. Giorn. Bot. Ital. n. s. xvii. (1910) 227.—Hupeh.

FRANCHETTI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 28.—Szechuen.

FRAXINELLUM, Diels. *Aspidium fraxinellum*, Christ in Bull. Herb. Boiss. vii. (1899) 15.—Kweichau: Yunnan: Szechuen.

Var. INÆQUALE, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 264.—Kweichau.

GLACIALE, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 28.—Yunnan: Szechuen.

HANCOCKII, Diels. *Ptilopteris Hancockii*, Hance in Journ. Bot. xxii. (1884) 139. *Aspidium reductum*, Bak.—Formosa.

HECATOPTERUM, Diels in Eng. Jahrb. xxix. (1900) 193. *P. auriculatum*, var. *stenophyllum*, Bak.—Szechuen.

Var. MARGINALE, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 114.—Kweichau.

HENRYI, Christ in Lecomte, Not. Syst. i. (1909) 36.—Yunnan.

HOOKERIANUM, C. Chr. *Lastrea Hookeriana*, Presl. *Aspidium caducum*, Wall.; Christ in Bull. Herb. Boiss. vi. (1898) 969.—Yunnan.

ICHANGENSE, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 28. *Aspidium auriculatum*, var. *ichangense*, Bak.—Hupeh.

ILICIFOLIUM, Moore; C. Chr., Ind. Fil. (1906) 582. *Aspidium ilicifolium*, Don.—Yunnan.

Var. DELAVAYI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 31.—Yunnan.

LACHENENSE, Bedd.; Diels in Engl. Jahrb. xxix. (1900) 192. *Aspidium lachenense*, Hook.—Shensi.

LANCEOLATUM, Diels. *Aspidium lanceolatum*, Bak. in Gard. Chron. n. s. xiv. (1880) 494.—Hupeh.

LEPIDOCAULON, J. Sm. *Aspidium lepidocaulon*, Hook.; Palibin in Act. Hort. Petrop. xix. (1901) 41.—Formosa: Korea.

LOBATUM, Presl; Diels in Engl. Jahrb. xxix. (1900) 193. *Polypodium lobatum*, Huds. *Aspidium lobatum*, Sw. *A. aculeatum* Sw., partly Hook. & Bak.—China, North and West.

POLYSTICHUM LOBATUM.

Var. SINENSE. *Aspidium Prescottianum* var. *sinense*, Christ in Bull. Soc. Bot. Ital. (1901) 289.—Shensi.

Var. SQUARROSUM, Bak.; C. Chr., Ind. Fil. (1906) 283. *Aspidium squarrosum*, D. Don.—Kwangtung

LONCHITOIDES, Diels. *Aspidium lonchitoides*, Christ in Bull. Herb. Boiss. vii. (1899) 16.—Kweichau: Yunnan: Hupeh.

LONGIPALEATUM, Christ in Lecomte, Not. Syst. i. (1909) 35.—Yunnan.

MARTINI, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 263.—Kweichau.

MAXIMOWICZII, Diels; C. Chr., Ind. Fil. (1906) 584. *Polypodium Maximowiczii*, Bak.—Loochoo.

MICHELII, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 16.—Kweichau.

MINUSCULUM, Christ in Bull. Soc. Bot. France, Mém. i. (1905) 31.—Yunnan: Szechuen.

MONOTIS, C. Chr., Ind. Fil. (1906) 584. *Aspidium monotis*, Christ.—Kweichau; Szechuen.

MOUPINENSE, Bedd.; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 113. *Aspidium moupinense*, Franch.—Szechuen: Shensi.

NEPALENSE, C. Chr. *Aspidium nepalense*, Spreng. *A. marginatum*, Wall. *A. manmeinense*, Christ in Bull. Herb. Boiss. vi. (1898) 965.—Yunnan.

NEPHROLEPIOIDES, Christ in Bull. Acad. Géogr. Bot. xi. (1902) 258.—Kweichau.

NIITAKAYAMENSE, Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 243.—Formosa.

OBLIQUUM, Moore. *Aspidium obliquum*, D. Don. *A. cæspitosum*, Wall.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 26.—Yunnan: Szechuen: Formosa.

OMEIENSE, C. Chr. *Aspidium caruifolium*, Bak. in Journ. Bot. xxvi. (1888) 228.—Szechuen.

PARVULUM, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 114.—Szechuen: Kweichau.

PINFAENSE, Christ, *l. c.* (1909) Mém. 177 (nomen).—Kweichau.

PRÆLONGUM, Christ, *l. c.* xi. (1902) 260.—Kweichau: Yunnan.

PRESCOTTIANUM, Moore; Christ in Bull. Soc. Bot. Ital. x. (1901), 289. *Aspidium Prescottianum*, Wall.—Szechuen: Shensi.

SETOSUM, Schott; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 111. *Aspidium setosum*, Wall.—Szechuen.

SHENSIENSE, Christ, *l. c.* 113.—Shensi.

SINENSE, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 30. *P. Prescottianum*, var. *sinense*, Christ.—Szechuen: Yunnan.

SPECIOSUM, J. Sm. *Aspidium speciosum*, D. Don. *A. affine*, Wall.; Christ in Bull. Herb. Boiss. vi. (1898) 965.—Kweichau: Yunnan: Szechuen.

POLYSTICHUM STANDISHII, C. Chr. *Lastrea Standishii*, Moore in Gard. Chron. (1863) 292. *Aspidium laserpitiifolium*, Mett. *A. festinum*, Hance.—Kwangtung : Loochoo.

STENOPHYLLUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 27.—Szechuen.

SUBMITE, Diels in Engl. Jahrb. xxix. (1900) 192. *Aspidium submite*, Christ.—Shensi.

TRIPTERON, Presl. *Aspidium tripteron*, Kunze ; Kom. in Act. Hort. Petrop. xx. (1901) 129.—Szechuen : Hupeh : Manchuria : Korea.

TSUS-SIMENSE, J. Sm. *P. lobatum*, forma. *Aspidium tsus-simense*, Hook. ; Diels in Engl. Jahrb. xxix. (1900) 192.—China, South : Korea.

VARIUM, Presl. *Polypodium varium*, Linn. *Aspidium varium*, Sw. ; Hook. & Bak., Syn. Fil. ed. ii. 254.—China : Manchuria : Korea.

Var. FRUCTUOSUM, Christ in Bull. Herb. Boiss. vi. (1898) 967.—Yunnan.

Var. OBTUSUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 43.—Yunnan.

VITTATUM, C. Chr. *Cyrtomium vittatum*, Christ, *l. c.* 33—Yunnan : Korea.

XIPHOPHYLLUM, Diels in Engl. Jahrb. xxix. (1900) 192 *Aspidium xiphophyllum*, Bak.—Szechuen.

YUNNANENSE, Christ in Lecomte, Not. Syst. i. (1909) 34.—Yunnan.

PTERIDIUM AQUILINUM, Kuhn. *Pteris aquilina*, Linn. ; Benth., Fl. Hongk. (1861) 449.—China : Manchuria : Korea.

Var. LANUGINOSUM, Bory (pro specie) ; Hayat. in Journ. Coll. Sc. Tokyo, xxv. (1908) 245.—Formosa.

Var. OSMUNDOIDES, Christ in Bull. Acad. Géogr. Bot. xix. (1910) 9.—Korea.

PTERIS ACTINOPTEROIDES, Christ in Bull. Herb. Boiss. vii. (1899) 6.—Yunnan : Szechuen : Hupeh.

asperula, *J. Sm.*=P. biaurita, *Linn.*

BIAURITA, Linn. ; Hook. & Bak., Syn. Fil. ed. ii. 164.—China, South.

CHEILANTHOIDES, Hayat. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 619.—Formosa.

CRETICA, Linn. ; Diels in Engl. Jahrb. xxix. (1900) 202.—China, West and North : Korea : Formosa : Loochoo.

Var. CARTILAGIDENS, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 56.—Yunnan.

Var. ROSTHORNII, Diels in Engl. Jahrb. xxix. (1900) 202.—China, Centr.

Var. SUBUMBROSA, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 131.—Yunnan.

PTERIS DACTYLINA, Hook.; Diels in Engl. Jahrb. xxix. (1900) 202.—Yunnan: Szechuen.

DECRESCENS, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 244.—Kweichau: Kwangtung.

DELTODON, Bak. in Journ. Bot. xxvi. (1888) 226.—Kwangtung: Szechuen.

DIMORPHA, Copel. in Philipp. Journ. Sc. iii. v. (1908) 282.—Kwangtung.

ENSIFORMIS, Burm. *P. crenata*, Sw.; Benth., Fl. Hongk. (1861) 448.—China: Formosa.

ESQUIROLII, Christ in Lecomte, Not. Syst. i. (1909) 50.—Kweichau.

EXCELSA, Gaud.; Diels in Engl. Jahrb. xxix. (1900) 202.—Kweichau: Yunnan: Szechuen: Hupeh: Quelpart I.

FORMOSANA, Bak. in Journ. Bot. xxiii. (1885) 103.—Formosa.

GEMINATA, Wall. *P. Kleiniana*, Presl; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 57.—Szechuen: Formosa.

GREVILLEANA, Wall.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 621.—Fokien: Formosa.

HENRYI, Christ in Bull. Herb. Boiss. vi. (1898) 957.—Yunnan.

INÆQUALIS, Bak. in Journ. Bot. xiii. (1875) 199.—Kiangsi: Hupeh: Szechuen.

incisa, *Thunb.*=Histriopteris incisa, *J. Sm.*

INSIGNIS, Mett. in Journ. Bot. vi. (1868) 269.—Kwangtung.

Kleiniana, *Presl*=P. geminata, *Wall.*

LONGIFOLIA, Linn.; Benth., Fl. Hongk. (1861) 447.—China, South and Centr.: Formosa: Loochoo.

Var. AURICULATA, Milde; Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 89.—Shensi.

LONGIPES, D. Don; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 621.—Formosa.

LONGIPINNULA, Wall.; Christ in Bull. Herb. Boiss. vi. (1898) 956.—Kweichau: Yunnan: Szechuen.

marginata, *Bory*=P. tripartita, *Sw.*

MORRISONICOLA, Hayat. in Bot. Mag. Tokyo, xxiii. (1909) 33.—Formosa.

MULTIFIDA, Poir. *P. serrulata*, Linn. fil.; Benth., Fl. Hongk. (1861) 448.—Hongkong: China, West and North: Korea.

Var. OBTUSA, Christ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 623.—Formosa.

INTERMEDIA, Christ in Nuov. Giorn. Bot. Ital. n. s. iv. (1897) 89.—Shensi.

NANA, Christ. *P. trifoliata*, Christ in Bull. Herb. Boiss. vii. (1899) 7.—Kweichau: Yunnan.

Var. QUINQUEFOLIATA, Copel. in Philipp. Journ. Sc. iii. v. (1898) 282.—Kwangtung.

PTERIS QUADRIAURITA, Retz.; Diels in Engl. Jahrb. xxix. (1900) 202. *P. biaurita*, Linn.—China : Formosa.

Var. DUCLOUXII, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 56.—Yunnan.

PARVILOBA, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 149.—Kweichau.

PAUPERCULA, Christ, *l. c.* xvi. (1906) 131.—Szechuen.

PLUMBEA, Christ in Lecomte, Not. Syst. i. (1909) 49.—Kwangtung.

SEMIPINNATA, Linn.; Benth., Fl. Hongk. (1861) 448.—China, South : Formosa : Loochoo : Korea.

Var. DISPAR, Kunze; Christ in Bull. Soc. Bot. Ital. 1901, 293.—China, South : Formosa.

serrulata, *Linn. fil.*=P. multifida, *Poir.*

STENOPHYLLA, Wall. *P. cretica*, var. *stenophylla*, Bak.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 620.—Formosa.

trifoliata, *Christ*=P. nana, *Christ.*

TRIPARTITA, Sw.; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 131. *P. marginata*, Bory. *P. yunnanensis*, Christ.—Yunnan : Formosa.

Var. MAGNA, Christ in Bull. Herb. Boiss. sér. 2, i. (1901) 1016.—Loochoo.

WALLICHIANA, Agardh; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 623.—Formosa.

yunnanensis, *Christ*=P. tripartita, *Sw.*

SALVINIA NATANS, Allm.; Diels in Engl. Jahrb. xxix. (1900) 209. *Marsilea natans*, Linn.—China, Centr. : Manchuria.

SCHIZOLOMA ENSIFOLIA, J. Sm. *Lindsaya ensifolia*, Sw.; Benth., Fl. Hongk. (1861) 446.—China, South.

HETEROPHYLLUM, J. Sm. *Lindsaya heterophylla*, Dry.; Benth., Fl. Hongk. (1861) 446.—China, South.

SCOLOPENDRIUM, Adans.=PHILLITIS, Ludwig.

SELLIGUEA COCHLEARIS, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 142.—Kweichau.

CORAIENSIS, Christ in Fedde, Repert. Nov. Sp. v. (1908) 11.—Quelpart I. : Kweichau.

LÉVEILLEI, Christ in Bull. Acad. Géogr. Bot. xvii. (1907) 143.—Kweichau.

triphylla, *Christ*=Polypodium triglossum, *Bak.*

STENOCHLÆNA SORBIFOLIA, J. Sm. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 609. *Acrostichum sorbifolium*, Linn.—Yunnan : Formosa.

Var. RIGIDA, Yabe ; Matsum. & Hayat. *l. c.*—Formosa.

STRUTHIOPTERIS, Willd. = MATTEUCCIA, Todaro.

TRICHOMANES AURICULATUM, Blume ; Hook. & Bak., Syn. Fl. ed. ii. 82.—China, South and West : Formosa : Loochoo.

BIMARGINATUM, v. d. Bosch. *T. neilgherense*, Bedd. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 566.—Formosa.

BIPUNCTATUM, Poir. ; Matsum. & Hayat. *l. c.* 564. *Hymenophyllum Filicula*, Bory.—China : Formosa : Korea.

CUPRESSOIDES, Desv. *T. obscurum*, Blume ; Christ in Bull. Herb. Boiss. sér. 2, i. (1901) 1016.—Loochoo.

FARGESII, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 10.—Szechuen.

FORMOSANUM, Yabe in Bot. Mag. Tokyo, xvi. (1902) 45.—Formosa.

HUMILE, Forst. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 565.—Formosa.

INTRAMARGINALE, Hook. ; Benth., Fl. Hongk. (1861) 463.—Hongkong.

japonicum, *Franch. et Savat.* = T. orientale, *Christ.*

JAVANICUM, Blume ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 565.—Formosa : Loochoo.

KURZII, Bedd. *T. nanum*, v. d. Bosch : Matsum. & Hayat. *l. c.* 566.—Formosa.

LATEMARGINALE, Eaton ; Hook. & Bak., Syn. Fil. ed. ii. 79.—Hongkong.

LIUKIUENSE, Yabe in Bot. Mag. Tokyo, xix. (1905) 35.—Loochoo.

MAKINOI, C. Chr. *T. acutum*, Mak. ; Christ in Bull. Herb. Boiss. vii. (1899) 2.—Yunnan.

MATTHEWII, Christ in Lecomte, Not. Syst. i. (1909) 56.—Kwangtung.

MAXIMUM, Blume ; Mak. in Bot. Mag. Tokyo, xii. (1898), *Pars Jap.* 193.—Loochoo.

MIYAKII, Yabe in Bot. Mag. Tokyo, xix. (1905) 34.—Formosa.

MOTLEYI, v. d. Bosch ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 566.—Formosa.

NASEANUM, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 11.—Szechuen : Loochoo.

neilgherense, *Bedd.* = T. bimarginatum, *v. d. Bosch.*

OMPHALODES, C. Chr. *T. peltatum*, Bak. ; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 567.—Formosa : Loochoo.

TRICHOMANES ORIENTALE, C. Chr. *T. japonicum*, Franch. et Savat.; Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 106.—China, South: Formosa: Korea.

Var. ANGUSTATUM, Christ in Bull. Acad. Géogr. Bot. xviii. (1909) 146.—Quelpart I.

Var. OSHIMENSE, Christ in Bull. Herb. Boiss. sér. 2, i. (1901) 1016.—Loochoo.

PALLIDUM, Blume; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 566.—Formosa.

PARVULUM, Poir.; Benth., Fl. Hongk. (1861) 462.—China, South: Formosa: Korea.

peltatum, *Bak.*=T. omphalodes, *C. Chr.*

RADICANS, Sw.; Bak. in Journ. Bot. xxvi. (1888) 225.—Szechuen: Fokien: Formosa.

Var. ANCEPS, C. B. Clarke. *T. anceps*, Wall.; Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 101.—Yunnan: Loochoo.

RIGIDUM, Sw.; Matsum. & Hayat. in Journ. Coll. Sc. Tokyo, xxii. (1906) 568.—Kongkong: Formosa: Loochoo.

STENOSIPHON, Christ in Fedde, Repert. Nov. Sp. v. (1908) 10.—Quelpart I.

THYANOSTOMUM, Mak. in Bot. Mag. Tokyo, xii. (1898) 193.—Formosa: Loochoo.

VITTARIA CARCINA, Christ in Bull. Acad. Géogr. Bot. xiii. (1904) 109.—Kweichau.

COSTATA, Kunze?; Christ in Bull. Herb. Boiss. vii. (1899) 3.—Yunnan.

ELONGATA, Sw.; Christ in Bull. Acad. Géogr. Bot. xi. (1902) 202.—Kweichau: Yunnan: Szechuen: Fokien: Formosa: Korea.

FILIPES, Christ, *l. c.* xvii. (1907) 150.—Kweichau: Fokien.

FLEXUOSA, Fée; Copel. in Philipp. Journ. Sc. iii. v. (1908) 282.—Kwangtung.

LANCEOLA, Christ in Bull. Herb. Boiss. iv. (1896) 674. ? *V. japonica*, Miq.—China: Formosa.

LINEATA, Sw.; Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 12.—Szechuen.

SUBEROSA, Christ, *l. c.*—Szechuen.

WOODSIA ALPINA, Gray; Kom. in Act. Hort. Petrop. xx. (1901) 109.—*Acrostichum alpinum*, Bolton.—Manchuria.

Andersoni, *Christ*=W. lanosa, *Hook.*

CINNAMOMEA, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 122.—Szechuen.

WOODSIA DELAVAYI, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 45.—Yunnan.

ELONGATA, Hook.; Diels in Engl. Jahrb. xxix. (1900) 187.—Yunnan.

ERIOSORA, Christ in Fedde, Repert. Nov. Sp. v. (1908) 12.—Korea.

FRONDOSA, Christ, *l. c.* 12.—Korea.

GLABELLA, R. Br.; Kom. in Act. Hort. Petrop. xx. (1901) 112.—Manchuria.

HANCOCKI, Bak. in Ann. Bot. v. (1891) 196.—Szechuen: Chihli: Manchuria.

ILVENSIS, R. Br.; Kom. in Act. Hort. Petrop. xx. (1901) 111. *Acrostichum ilvense*, Linn.—Manchuria.

INDUSIOSA, Christ in Lecomte, Not. Syst. i. (1909) 44.—Yunnan.

LANOSA, Hook. *Gymnogramme Andersoni*, Bedd. *Woodsia Andersoni*, Christ in Bull. Soc. Bot. France, lii. Mém. i. (1905) 45.—Yunnan: Szechuen.

MACROCHLÆNA, Mett.; Kuhn in Journ. Bot. vi. (1868) 270.—Shantung.

MANCHURIENSIS, Hook.; Kom. in Act. Hort. Petrop. xx. (1901) 108.—China, West: Manchuria: Korea.

POLYSTICHOIDES, Eaton; Diels in Engl. Jahrb. xxix. (1900) 187.—China, West and North: Manchuria: Korea.

ROSTHORNIANA, Diels in Engl. Jahrb. xxix. (1900) 187.—China, West.

SINUATA, Christ in Bull. Herb. Boiss. sér. 2, ii. (1902) 830. *W. polystichoides*, var. *sinuata*, Hook.—China, North: Korea.

VEITCHII, Christ in Bull. Acad. Géogr. Bot. xvi. (1906) 121.—Szechuen.

WOODWARDIA HARLANDII, Hook.; Benth., Fl. Hongk. (1861) 445.—Hongkong: Kwangtung.

JAPONICA, Sm.; Diels in Engl. Jahrb. xxix. (1900) 199. *Blechnum japonicum*, Linn. fil.—China, South and West: Kiangsi: Formosa: Quelpart I.

KEMPII, Copel. in Philipp. Journ. Sc. iii. v. (1898) 280.—Kwangtung.

RADICANS, Sm.; Diels in Engl. Jahrb. xxix. (1900) 199. *Blechnum radicans*, Linn. *Woodwardia orientalis*, Sw.—Hongkong: Kwangtung: Yunnan: Szechuen: Hupeh: Shensi: Formosa.

A Revision of the Genus *Actinidia*, Lindl. By STEPHEN TROYTE DUNN, B.A., F.L.S., F.R.G.S., sometime Superintendent of the Botanical and Forestry Department, Hongkong, China.

(PLATE 25.)

[Read 2nd February, 1911.]

ACTINIDIA, Lindl. Introd. Nat. Syst. ed. ii. 439 (1836); Planch. in Lond. Journ. Bot. vi. (1847) 302; Benth. in Journ. Linn. Soc. v. (1861) 54, Fl. Hongkong. (1861) 26; Benth. et Hook. f., Gen. Pl. i. (1862) 184; Baill., Hist. des Pl. i. (1867–9) 114; Miq. in Ann. Mus. Bot. Lugd.-Bat. iii. (1867) 15; Maxim. in Bull. Acad. Sci. St. Pétersb. xxxi. (1887) 17; in Act. Hort. Petrop. xi. (1890) 34; Gilg in Engl. u. Prantl, Pflanzenfam. iii. 6 (1893) 125; Van Tiegh. in. Journ. de Bot. xiii. (1899) 170; Finet et Gagn., Fl. As. Or. ii. (1905) 16; C. K. Schneider, Ill. Handb. Laubholzk. ii. (1909) 323.

Trochostigma, Sieb. et Zucc. in Abh. Akad. Wiss. Muench. iii. (1843) 726, t. 2, f. 2; Endl., Gen. Pl. Suppl. iii. 94 (1843).

Kalomikta, Regel in Bull. Phys. Math. Acad. Pétersb. xv. (1857) 219.

Frutices diffusi, scandentes vel erecti. Folia alterna, simplicia, sæpius serrulata, coriacea vel membranacea, penninervia; stipulæ minutæ, caducissimæ. Cymæ axillares vel in ramis brevibus floriferis dispositæ, 1–∞-floræ, bracteolatæ. Flores polygami; sepala 5, rarius 2–4, libera, imbricata v. rare valvata; petala 5, rarius 4, hypogyna, libera vel basi connata, valde imbricata; stamina ∞, libera v. basi connata et corollæ basi sæpe adnata, antheris versatilibus, sæpe sagittatis, extrorsis, 2-locularibus, loculis parallelis, rima dehiscentibus; discus 0; ovarium liberum, basi latum, ∞-loculare, carpellis rarius in medio vix cohærentibus; styli loculorum numero æquales, ima basi contigui vel in carpellis propriis separatim ortis, in annulum instructi; ovula ∞ in loculis, axillaria, horizontalia, anatropa [integumento unico, Van Tiegh.]. Bacca multilocularis. Semina in pulpa immersa, parva, 2–3 mm. longa; testa cartilaginosa, pellucida, sicco reticulata, tegmine crustaceo nitido; albumen copiosum, carnosum; embryo axilis, cylindricus, rectus, dimidium seminis sæpius excedens, radicula juxta hilum.

The Actinidias hold somewhat the same position in the vegetation of the Far East that the brambles do in this country—that is to say, they provide a large part of the shrubby growth in wood borders and in hedges, in districts in which they abound, climbing over small trees when occasion offers or forming large straggling bushes on the hill-sides. Their long weak shoots do not, however, as in the case of the brambles, hook themselves on to their supports by means of thorns, they rather elbow their way by means of short divergent side branches until they find access to the light above them. As in

Rubus, the inflorescences are usually produced on the second year's growth, which is sometimes a normal leafy branch, sometimes a special flower-bearing spur. The long arching shoots which appear during the spring and summer months give rise in the following year to secondary branches bearing leaves which are often strikingly different in shape and character from those on the primary stems—a point which will explain some anomalies in series of specimens in herbaria. The flowers are usually completely diœcious, and the male plants are considerably more common than the female.

The uses of the Actinidias, as at present known, are few. The long tough stems of the climbing forms are, like so many lianes in countries devoid of cheap cordage, used for binding field and mountain produce both in Japan and China. The fruits, which in several species have a greenish pulp of pleasant acid taste, somewhat resembling that of gooseberries, are collected and eaten in many parts of those countries.

History.—The specimens upon which the genus was founded were collected in Nepal in 1821 by Wallich, who attached to them his number 6634 and the following note:—"*Dilleniacearum ordinis? callosa, Wall. Trachytillæ, Dec. ulla affinitas?*" Some of these specimens, which were in flower only, eventually came into the hands of Lindley and were recognised by him as separable from all genera then known by their climbing habit in conjunction with the peculiar radiating arrangement of their styles. He therefore described them[*] as a new genus of Dilleniaceæ in 1836 and chose for it the name *Actinidia* in consequence of the last-mentioned character[†]. It was about seven years later that Siebold and Zuccarini obtained abundant flowering and fruiting specimens of several apparently congeneric species of climbing Ternstrœmiaceous shrubs from the mountains of South Japan. They had succulent fruit and conspicuously radiating styles. They were, in fact, Actinidias, but these authors, not suspecting that Lindley's Indian genus of Dilleniaceæ had any connection with their plants, described them[‡] in 1843 as five species of a new genus of Ternstrœmiaceæ, viz. *Trochostigma*[§]. As one of these proved to be a *Schizandra* and the remaining four were subsequently reduced to two, the genus now comprised three species. A fourth, discovered by Fortune in China, was described in 1847 by Planchon[‖], who at the same time declared the generic identity of *Actinidia* and *Trochostigma*. Scarcely two years, however, had elapsed after Planchon's unification of the genus, when Gardner, with specimens of what is now known as *Actinidia Championi*, identified them[¶] with a third genus in a third natural order, viz. with *Heptaca*, a doubtful Tiliaceous genus of Loureiro. It is easy to understand how Gardner was led into this mistake when it is observed how very slightly imbricate, in fact almost valvate, the sepals of the male flowers of that species are. Gardner had no female flowers. Probably Champion, who sent him the specimens from Hongkong, was unable to find that sex, as it is extremely rare there, though the male plants are frequent about the island. The true affinities of the plant were recognised by Bentham in his 'Flora Hongkongensis' a few years later.

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[*] Introd. Nat. Syst. ed. ii. 439 (1836).

[†] ἀκτὶς, a star.

[‡] Abh. Akad. Wiss. Muench. iii. (1843) 726.

[§] τροχὸς, a wheel.

[‖] Lond. Journ. Bot. vi. (1847) 302.

[¶] Hooker's Kew Journ. i. (1849) 293.

Meanwhile, a sixth species, known in Manchuria as *Kalomikta*, was described by Maximowicz[*] as a *Prunus* and was subsequently made by Regel[†] the type of a new genus under the name of *Kolomikta*, being finally placed in its true position as *Actinidia Kolomicta* by Maximowicz. A few years later Hooker and Thompson added a species from India[‡] and Bentham another from S. China[§]. The latter was the first example of the type, now well known, which is distinguished by the thick indumentum of the leaves and flowers. Meanwhile important collections from the interior of China were beginning to arrive in Europe, and between 1884 and 1895 five new Chinese members were added to the now considerable genus by Hemsley[‖], Franchet[¶], Maximowicz[**], and Hance[††]. To these thirteen species, seven more were added between 1905 and 1909, all from the interior of China, while the novelties described in this paper bring the total number up to twenty-four.

Systematic Position.—It may be stated by way of preface that practically all botanists who have given attention to the systematic position of *Actinidia* have placed it either in Dilleniaceæ or in Ternstrœmiaceæ, and that it is therefore unnecessary to discuss its relations with any other families. The founder of the genus considered[‡‡] that it belonged to Dilleniaceæ in consequence of its numerous carpels, free styles, and, as he supposed, innate anthers, all of which were characteristic of his idea of that Order. Their absence among the genera, so far as they were known to him, of Ternstrœmiaceæ would have prevented him from including it in that family. He did not possess fruit. When six years later Siebold and Zuccarini[§§] with abundant material including fruit described their genus *Trochostigma*, which, as we have seen, proved to be congeneric with *Actinidia*, they recognised its close affinities with *Saurauja* and placed it, but with some doubt, in Ternstrœmiaceæ. In the same year, 1843, it was included in the third Supplement of Endlicher's 'Genera Plantarum'[‖‖], and placed next to *Sauravja* in his tribe Sauraujeæ of Ternstrœmiaceæ. The next two Actinidias that were discovered, happening to have their sepals only slightly imbricate, and their fruit not being available, were placed by their authors, Regel * and Gardner †, under the generic names of *Kalomikta* and *Heptaca*, in Tiliaceæ, an allied natural order, but one from which the characters of the embryo would, if they had been known, at once have separated them. Planchon ‡, in his discussion of the affinities of the Cochlospermeæ, added a further argument in favour of Lindley's opinion as to the systematic position of *Actinidia* by drawing attention to the similarity in the peduncles of that genus with those of many Dilleniaceæ.

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[*] In Rupr. in Bull. Phys. Math. Acad. xv. (1857) 262.

[†] Bull. Phys. Math. Acad. xv. (1857) 219.

[‡] *A. strigosa.*

[§] *A. eriantha.*

[‖] *A. lanata.*

[¶] *A. Davidii* and *A. melanandra.*

[**] *A. tetramera.*

[††] *A. fulvicoma.*

[‡‡] Lindley, Introd. Nat. Syst. ed. ii. (1836) 439.

[§§] Abh. Akad. Wiss. Muench. iii. (1843) 726.

[‖‖] Page 94.

The next contribution to the subject was made by Bentham in 1861 in this journal §, where, in discussing the genera which could most naturally be placed together under the name of Ternstrœmiaceæ, he pointed out that *Saurauja* and *Actinidia* could not be separated. While admitting the close relationship of the latter with Dilleniaceæ, and especially with *Dillenia*, he held that its anthers and seeds, and its close connection with *Saurauja*, which, though bearing a remarkable superficial resemblance to *Dillenia*, is widely divergent in floral structure, are sufficient to exclude it from that natural order. He therefore followed Endlicher in placing *Actinidia* and *Saurauja* together under the Ternstrœmiaceous tribe Sauraujeæ, and this arrangement was followed in the first volume of Bentham and Hooker's 'Genera Plantarum' ‖ which appeared in the following year. A few years later Baillon was commencing a critical review of the Polypetalæ for his 'Histoire des Plantes,' and in dealing with the Dilleniaceæ included *Actinidia* ¶ on the sole ground of the close similarity of its floral structure to that of *Dillenia*. Among the seven characters upon the great frequency of which throughout the Dilleniaceæ Baillon relies for the coherence of that Natural Order, as understood by him, there are only two which are not common to the Ternstrœmiaceæ—these are the independence of the carpels and the presence of an aril; and when we remember that in these two respects *Actinidia* is at variance with the Dilleniaceæ while in agreement with Ternstrœmiaceæ, it is difficult to understand Baillon's attitude in the matter. At all events most botanists who had to deal with our genus up to the date of the publication of Engler and Prantl's 'Pflanzenfamilien' seem to have been in agreement with Bentham. Maximowicz, however, in describing ** an *Actinidia* collected by Potanin in North-west China in 1885, remarked that the disagreement of eminent authorities as to the systematic position of the genus left him in such doubt that he preferred to be guided by the anatomical character furnished by the presence of raphides in the cells of *Actinidia*, which thus resembles many Dilleniaceæ while differing from Ternstrœmiaceæ. In the same number of the 'Acta,' however, he transferred *Clematoclethra*, which was at that time regarded as a section of *Clethra* in Eriaceæ, and placed it next to *Actinidia*. The placing together of the two genera, though undoubtedly correct, furnished in reality an argument against his recently made decision and provided a new reason for the inclusion of both in Ternstrœmiaceæ, for *Clematoclethra* with its united styles, few loculi, few seeds, with smaller albumen and larger embryo is very different from all Dilleniaceæ.

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* Bull. Phys. Math. Acad. Pétersb. xv. (1857) 219.

† Hooker's Kew Journ. i. (1849) 293.

‡ London Journ. Bot. vi. (1847) 302.

§ Bot. vol. v. p. 54.

‖ Page 184.

¶ Vol. i. p. 114.

** Acta Hort. Petrop. xi. (1890) 34.

In 1893 Gilg contributed to Engler and Prantl's 'Pflanzenfamilien' his account of the Dilleniaceæ, making therein a separate section for *Actinidia* between *Dillenia* and *Saurauja*. The distinguishing characters between Dilleniaceæ and Theaceæ (Ternstrœmiaceæ) are stated to be the aril, the abundant albumen, and the minute embryo. On two of these characters, the first and last, *Actinidia* and *Saurauja* would be excluded from Dilleniaceæ, and as the quantity of albumen is variable in Ternstrœmiaceæ (absent, for instance, in *Eurya*) their inclusion in the former Natural Order is difficult to follow.

From what has been said it is clear that some considerable divergence exists between the opinions of the numerous eminent botanists who have discussed the systematic position of *Actinidia* and the group of genera to which it belongs. A review of the facts must now be taken. In locating a group of genera possessing admitted affinities with two Natural Orders the systematist must follow one of three courses according to the strength, in his judgment, of the affinities of the members of the group (1) *inter se*, (2) with one of the Natural Orders, (3) with both. In the first case, the affinities *inter se* being strong and those with the two Natural Orders weak it would be proper to make a new natural order. In the second case the group would naturally be attached to the natural order with which its affinity predominated. In the third case there being strong affinities with both natural orders the boundary between the two for practical purposes would be broken down and some systematic compromise would be necessary to avoid their fusion into one. I hope to be able to show that the second solution is the one applicable to this case—that is to say, that *Saurauja* is inseparable from Ternstrœmiaceæ, while the remaining two, *Actinidia* and *Clematoclethra*, can be properly excluded from Dilleniaceæ.

Saurauja differs from all Dilleniaceæ in its coherent petals, versatile anthers, united styles, numerous small seeds, and in the moderate (not minute) embryo. All these characters are common to a considerable number of the genera of Ternstrœmiaceæ, some, indeed, to all of them. *Clematoclethra* closely agrees with *Saurauja*. The only point, on the other hand, in which they agree with Dilleniaceæ rather than with Ternstrœmiaceæ is in the presence of raphide-bearing cells, and this anatomical character will probably not be considered of so much systematic importance as those of floral structure. It now remains to be seen whether *Actinidia*, which undoubtedly possesses close affinities with *Dillenia*, can properly be excluded from Dilleniaceæ. *Actinidia* agrees with Dilleniaceæ in its many-celled ovary, its free styles, and in the copious albumen of its seeds. But these characters are also to be found in many genera of Ternstrœmiaceæ. *Omphalocarpum*, for instance, has very numerous ovarian cells, while free styles and copious albumen are not uncommon in the Order. On the other hand, it agrees with *Ternstrœmiaceæ* in its versatile anthers, its numerous seeds, and its moderate-sized embryo—characters which are entirely absent among Dilleniaceæ.

In the opinion of the writer, too much weight has been given to the resemblance, which is certainly most striking, between the foliage of *Saurauja* and *Dillenia* and between the hermaphrodite flowers of *Actinidia* and those of *Dillenia*. The essential characters are not found upon investigation to be in close agreement. A critical comparison, in fact, of all the structural characters upon the importance of which for classification botanists very generally agree, shows a convincing agreement of *Actinidia*, and even more so of the remainder of the group, with Ternstrœmiaceæ and a corresponding disagreement with the Dilleniaceæ.

SYSTEMATIC ARRANGEMENT OF *ACTINIDIA*.

Sect. 1. AMPULLIFERÆ.—Leaf surface glabrous, nerves and nerve-axils sometimes pubescent; ovary bottle-shaped; fruit without spots.

Anthers brown or black.	
Leaf-veins not uniformly setose.	
Claw of petals greenish	1. *melanandra*, Franch.
Claw of petals brown	2. *rufa*, Miq.
Leaf-veins uniformly setose	3. *Giraldii*, Diels.
Anthers yellow.	
Flowers pentamerous	4. *polygama*, Miq.
Flowers 2–4-merous.	
Sepals imbricate	5. *tetramera*, Maxim.
Sepals valvate	6. *valvata*, Dunn.

Sect. 2. LEIOCARPÆ.—Leaves slightly woolly on the veins, shoots quite glabrous; ovary glabrous, cylindric; fruit without spots	7. *Kolomicta*, Maxim.

Sect. 3. MACULATÆ.—Leaves usually quite glabrous; ovary cylindric; fruit spotted.

Ovary pubescent.	
Leaves thickly coriaceous	8. *coriacea*, Dunn.
Leaves chartaceous or membranous	9. *callosa*, Lindl.
Ovary glabrous..................................	10. *rubricaulis*, Dunn.

Sect. 4. VESTITÆ.—Leaves or shoots shaggy or woolly.

Peduncles copiously branched	11. *Championi*, Benth.
Peduncles little branched.	
Leaves destitute of stellate hairs.	
Mature leaves glabrous or thinly hairy.	[et Gagn.
Leaves orbicular	12. *holotricha*, Finet

Leaves oblong-lanceolate	
Leaves green beneath.	
Buds perulate	13. *strigosa*, Hook. f. et Thoms.
Buds eperulate	14. *Hemsleyana*, Dunn.
Leaves glaucous beneath	15. *Henryi*, Dunn.
Mature leaves densely hairy.	
Pubescence strigose	16. *rudis*, Dunn.
Pubescence velvety	17. *Davidii*, Franch.
Leaves tomentose with stellate hairs.	
Leaves cuneate at base	18. *lanceolata*, Dunn.
Leaves rounded or cordate at base.	
Petioles 6–8 mm. long	19. *eriantha*, Benth.
Petioles over 12 mm. long.	
Leaves broadly ovate.	
Young shoots setose	20. *chinensis*, Planch.
Young shoots woolly	21. *lanata*, Hemsl.
Leaves oblong.	
Leaves membranous	22. *fulvicoma*, Hance.
Leaves coriaceous	23. *pachyphylla*, Dunn.

Geographical distribution *.—The genus as at present known falls naturally into three divisions, distinguished by their floral and vegetative characters no less than by their geographical dispersion. One is essentially northern, extending over the islands of Sachalien and Japan across Manchuria to Shensi in N. China, and then penetrating to the south along the mountain-ranges of W. China, or, in other words, the eastern flank of Tibet, almost to the tropics in Yunnan. It is distinguished by its smooth stems and leaves, by its glabrous ovaries and unspotted fruit, and comprises the first two sections, which are separated principally by the marked difference in the shape of their ovaries. The Ampulliferæ, which, as their name implies, possess bottle-shaped ovaries, cover the whole of the region indicated. The most widely distributed species is *A. polygama*, the area of which is flanked near its southern extremity by the isolated areas of two closely allied species with reduced floral whorls, viz., *A. tetramera* on the west and *A. valvata* on the east. *A. rufa* has a range extending further south, but not so far north as *A. polygama*. The Leiocarpæ, represented at present by only one species, *A. Kolomicta*, have almost the same limits as the Ampulliferæ.

The Maculatæ, with mostly glabrous leaves and stems, but with their ovaries usually pubescent, form a natural transition between the above-mentioned sections and the next. They are, moreover, intermediate in geographical area. They occupy a well-defined band immediately north of the tropics from the Himalaya to Formosa. The first two sections are almost wholly to the north of this band, while the fourth is only so to a small extent, though reaching far beyond it to the south. The dispersion of the Maculatæ has evidently been along the southern flank of the Tibetan plateau and along the range which, running out from it in an easterly direction, forms the watershed between the great river-systems of S. China, the Yangtze and the West River.

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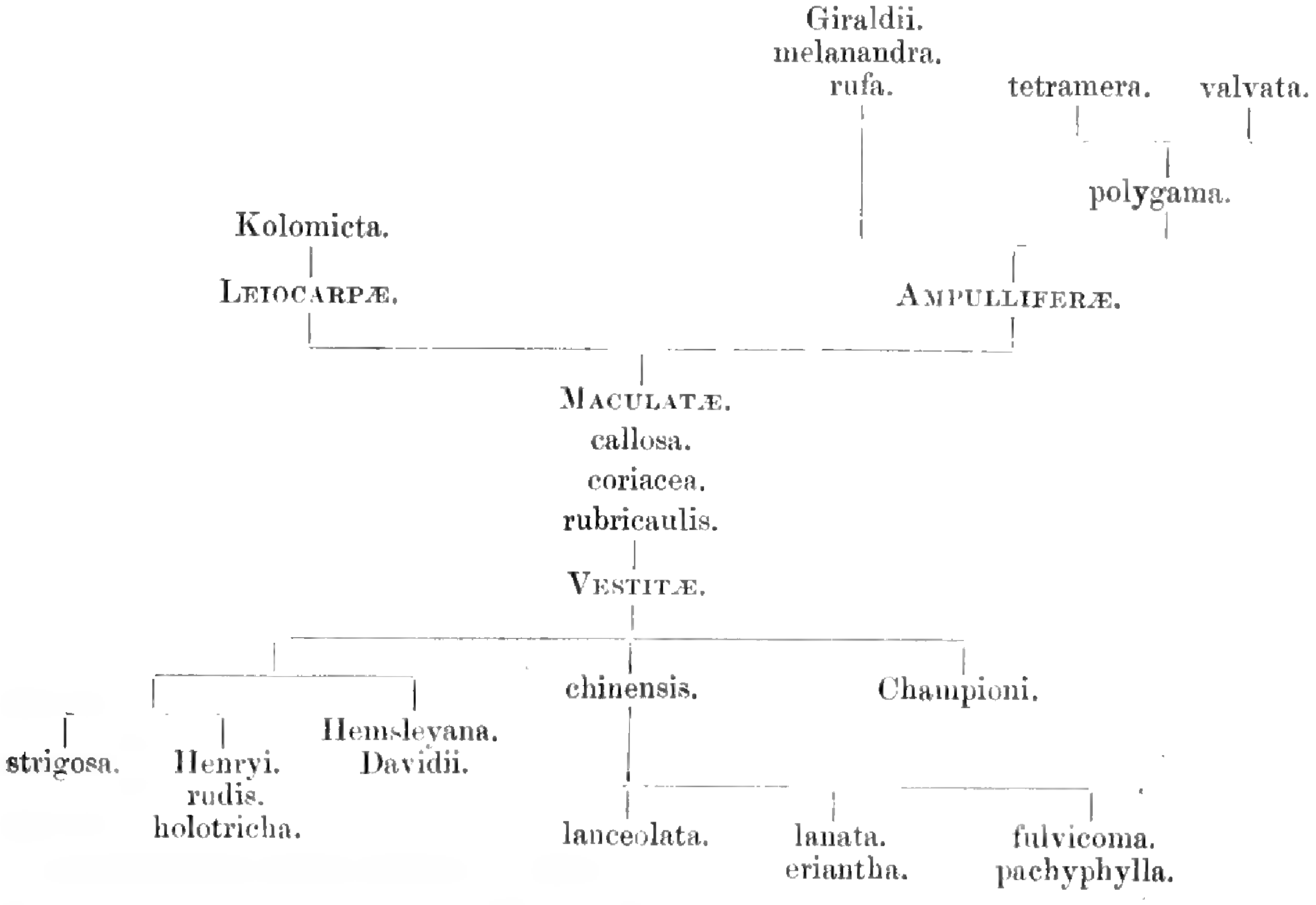
* See Map (Pl. 25).

The fourth section, Vestitæ, distinguished by the often dense strigose or woolly clothing of the leaves and stems, is richer in species than the other three combined. All the species are connected morphologically and geographically with *A. chinensis*, which is locally common in the mountains of West Central China. Three closely allied species * are found in Yunnan at the extreme south-west of its area, while six others † are congregated along the coastal provinces which form its eastward limits. *A. Championi*, which occupies a unique position in this section, and, in fact, in the genus, by reason of its elaborate inflorescence, holds likewise an extreme geographical area along the south-eastern borders of the generic area from Formosa to Sumatra.

The area of the whole genus thus extends from about the 50th degree N. latitude in Sachalien to the 8th S. latitude in Java, and from the 78th E. longitude in Kumaon to the eastern coasts of the continent and Japan.

The systematic relation and, to a limited extent, the geographical interdependence of the species are shown graphically in the following scheme :—


Giraldii.
melanandra.
rufa.
tetramera.
valvata.
polygama.
Kolomicta.
LEIOCARPÆ.
AMPULLIFERÆ.
MACULATÆ.
callosa.
coriacea.
rubricaulis.
VESTITÆ.
chinensis.
Championi.
strigosa.
Henryi.
rudis.
holotricha.
Hemsleyana.
Davidii.
lanceolata.
lanata.
eriantha.
fulvicoma.
pachyphylla.

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* *A. holotricha, Henryi, rudis.*

† *A. Hemsleyana, Davidii, lanceolata, lanata, fulvicoma,* and *pachyphylla.*

SECT. 1. **Ampulliferæ**, *Dunn*, sect. nov.

Pagina foliorum glabra ; ovarium ampulliforme ; bacca immaculata.

1. ACTINIDIA MELANANDRA, *Franch. in Journ. de Bot.* viii. (1894) 278 ; *E. Pritz. in Diels in Engl. Jahrb.* xxix. (1900) 470 ; *Finet et Gagn., Fl. As. Or.* ii. (1907) 21 ; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 326.

JAPAN, fide *Finet et Gagn.*

LOOCHOO Is., *Wright*, n. 31 !

CHINA : Szechuen, Tchen Kéou Tin, *Farges*, n. 406 ! *Wilson*, n. 3269 ! Kiangsi, Ningpo, *Faber*, n. 146 ! Yunnan, *Delavay* fide *Finet et Gagn.*

Var. LATIFOLIA, *E. Pritz. in Diels in Engl. Jahrb.* xxix. (1900) 470.

CHINA : Szechuen (fide *E. Pritz.*).

The species has typically somewhat coriaceous leaves, which are glaucous beneath and cuneate at the base, while the petals are without the brown coloration at the base which is characteristic of *A. rufa*, Miq.

2. A. RUFA, *Miq.*, sensu latiore ; *Kom. in Act. Hort. Petrop.* xxv. (1905) 35 ; *Finet et Gagn., Fl. As. Or.* ii. (1907) 21 ; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 326.—A. acuminata et suifuensis, *Bud. ex Kom. l. c.*

From Japan and Manchuria through Western China to Yunnan.

Var. 1. TYPICA. Sepala dorso venæque foliorum rufo-tomentosa. A. rufa, *Miq. in Ann. Mus. Bot. Lugd.-Bat.* iii. (1867) 15 ; *Franch. et Sav., Enum., Pl. Jap.* i. (1875) 58 ; *Maxim. in Bull. Acad. Sci. St. Pétersb.* xxxi. (1886) 19 (pro var.).—Trochostigma rufa, *Sieb. et Zucc. in Abh. Akad. Wiss. Muench.* iii. (1843) 726.

JAPAN, fide *Sieb. et Zucc.*

KOREA, fide Nakai.

CHINA : Hupeh, *Henry*, n. 5622 !

Var. 2. ARGUTA, *Dunn*, var. nov. Folia axillis venularum exceptis glabra. A. arguta, *Miq. in Ann. Mus. Bot. Lugd.-Bat.* iii. (1867) 15 ; *Franch. et Sav., Enum. Pl. Jap.* i. (1875) 58 ; *Maxim. in Bull. Acad. Sci. St. Pétersb.* xxxi. (1886) 19 ; *Ito et Matsum. in Journ. Coll. Sci. Tokyo*, xii. (1900) 280.—A. polygama, *Hook. f. in Bot. Mag.* t. 7497, non *Miq.*—Trochostigma arguta, *Sieb. et Zucc. in Abh. Akad. Wiss. Muench.* iii. (1843) 726.

MANCHURIA : Mukden, *James* ! Vladivostok, *Maxim.* ! S.E. Manchuria, *Maxim.* !

JAPAN : Nagasaki, *Oldham*, n. 863 ! Hakone, *Maxim.* ! Sapporo, *Tokubuchi* ! Hakodate, *Maxim.* !

KOREA, *Oldham*, n. 1004 !

LOOCHOO ISLANDS, fide *Ito et Matsum.*

CHINA : Petchili, Pekin Mts., *Bretschneider*, n. 158 ! Szechuen, *Farges*, n. 406 ! Yunnan, *Delavay*, n. 4264 ! *Henry*, n. 9694 ! n. 11008 !

Var. 3. CORDIFOLIA, *Dunn*, var. nov. Petioli venæque foliorum plus minus setosi. A. cordifolia, *Miq. in Ann. Mus. Bot. Lugd.-Bat.* iii. (1867) 15.—A. volubilis, *Carrière in Rev. Hort.* 1874, 395, fig. 54; *Ito, Fig. Pl. Keis. Bot. Gard.* ii. (1883) t. 21, non *Franch. et Sav.*

JAPAN: Cape Sangar, *Wright*! Sapporo, *Elwes*!

Var. 4. PARVIFOLIA, *Dunn*, var. nov. Folia parva, oblongo-lanceolata, serrulata.

CHINA: Hupeh, *Henry*, n. 5938 A! 6644! 6794!

The original description of *Trochostigma rufa*, Sieb. et Zucc., is so meagre that it might be equally well applied to *Actinidia callosa*, Lindl., were it not for the figure of the fruit which accompanies it. As it is specifically inseparable from *T. arguta*, Sieb. et Zucc., the description of which follows it in the original enumeration, its specific name has priority for the aggregate species.

It is a common climber in some parts of Japan. Its fruits are eaten and its sweet sap is used as a drink. Its long stems are used for rope and its bark is made into paper.

A. rufa, in its widest sense, may be distinguished from allied species by its long-stalked membranous leaves, glabrous except for the veins and vein-axils; largish flowers with petals more than twice the calyx; brown sagittate anthers; glabrous bottle-shaped ovary; and brown smooth shortly-beaked fruit.

3. A. GIRALDII, *Diels in Engl. Jahrb.* xxxvi. Beibl. 82 (1905) 75.

CHINA: Shensi, *Giraldi* fide *Diels.*

Approaches *A. rufa,* var. *cordifolia.*

4. A. POLYGAMA, *Miq., Prol. Fl. Jap.* (1866-7) 203; *Franch. et Sav., Enum. Pl. Jap.* i. (1875) 59; *Ito, Fig. Pl. Keis. Bot. Gard.* (1883) t. 20; *Maxim. in Bull. Acad. Sci. St. Pétersb.* xxxi. (1886) 19; *Gilg u. Loes. in Engl. Jahrb.* xxxiv. (1904) Beibl. 75, 52; *Kom. in Act. Hort. Petrop.* xxv. (1905) 39; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 327, f. 216, 217; *Finet et Gagn., Fl. As. Or.* ii. (1907) 20; *Nakai in Journ. Coll. Sci. Tokyo,* xxvi. (1909) 98.—A. volubilis, *Franch. et Sav. l. c.*—Trochostigma polygama, *Sieb. et Zucc. in Abh. Akad. Wiss. Muench.* iii. (1843) 727, t. ii. f. 2.—T. volubilis, *Sieb. et Zucc. l. c.*

SACHALIEN, fide *Maxim.*

MANCHURIA: Possiet Bay, *Maxim.*! Port Deans, Dundas, *Maxim.*!

JAPAN: Hakodate, *Maxim.*! Sapporo, *Miyabe*! Nagasaki, *Maxim.*!

KOREA, fide *Nakai.*

CHINA: Shantung, *Zimmermann* fide *Gilg;* Szechuen, Mt. Omi, *Wilson*, n. 4761!

Distinguishable among allied species by its setose leaf-veins, sepals woolly within, large corolla, yellow anthers, and bottle-shaped glabrous ovary. As an ornamental plant it is cultivated in many temperate countries. The leaves on the young shoots are frequently variegated with white and pink.

Ito states that *Watatabi* (the Japanese name of this species) is well known for its peculiar attraction for cats, which will collect from some distance round, exhibiting marks of intense excitement when withies or faggots of the shrub are brought into the village.

5. A. TETRAMERA, *Maxim. in Acta Hort. Petrop.* xi. (1890) 35; *Finet et Gagn., Fl. As. Or.* ii. (1907) 21; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 327.

CHINA: Kansu, fide *Maxim.* Szechuen, Kiala, *Soulie*, n. 802! *Farges*, n. 530!

6. A. VALVATA, *Dunn*, sp. nov. Frutex magnus. Caules juniores glabri, pallidi. Folia ovato-lanceolata, mucronato-serrata, 6–10 cm. longa, 3–5 cm. lata, papyracea, glabra, acuminata, basi cuneata, venis utrinque 5–6 arcuato-ascendentibus, laminis petiolo duplo longioribus. Flores 1–3-ni, brevipedunculati, axillares, pedicellis 1 cm. longis sparse puberulis, bracteolis linearibus minutis; sepala 2–3, a basi ad apicem stricte valvata, ovata, acuta, 9 mm. longa, interne puberula; petala oblonga, apice rotundata, imbricata, basi inter se et cum staminibus coalita, 12 mm. longa; antheræ luteæ; ovarium ampulliforme, glabrum, siccitate nigrum. Flores hermaphroditos petalis nuper delapsis tantum vidi.

CHINA: Kiangsi, Kewkiang, Lushan Mts., *Bullock*, n. 121!

SECT. 2. **Leiocarpæ**, *Dunn*, sect. nov.

Folia subglabra; rami novelli glabri; ovarium immaculatum, glabrum, cylindricum.

7. A. KOLOMICTA, *Maxim. in Mém. Acad. Sci. St. Pétersb.* ix. (1859) 63; *Carrière in Rev. Hort.* 1872, 395; *Regel in Gartenfl.* 1880, 184; *Maxim. in Bull. Acad. St. Pétersb.* xxxi. (1886) 19; *Hemsl. in Journ. Linn. Soc.* xxiii. (1886) 79; *Korsh. in Act. Hort. Petrop.* xii. (1892) 317; *E. Pritz. in Diels in Engl. Jahrb.* xxix. (1900) 470; *Kom. in Act. Hort. Petrop.* xxv. (1905) 36; *Diels in Engl. Jahrb.* xxxvi. Beibl. 82 (1905) 76; *Finet et Gagn., Fl. As. Or.* ii. (1907) 20; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 327, f. 216; *Nakai in Journ. Coll. Sci. Tokyo*, xxvi. (1909) 98.—A. platyphylla, *A. Gray, ex Miq. in Ann. Mus. Bot. Lugd.-Bat.* iii. (1867) 15, fide *Bretschneider*.—Prunus? Kolomikta, *Maxim. in Rupr. in Bull. Phys. Math. Acad.* xv. (1857) 262.—Kalomikta manshurica, *Regel in Bull. Phys. Math. Acad.* xv. (1857) 219.—Trochostigma Kolomicta, *Rupr. in Bull. Phys. Math. Acad.* xv. (1857) 262.

MANCHURIA: coast of Manchuria, 1859, *Wilford*! Vladivostok, *Maxim.*, 1860! *Wright*, n. 1121! Mukden and Chang-pei Shan, *James*, 1886!

JAPAN: Central Japan, 2000–7000 ft., *Maries*! Yezo, 5.8.87, *Hori*! Hakodate, *Maxim.*, 1861!

KOREA, fide *Komarov* et *Nakai*.

CHINA: frequent in Shensi, fide *Diels*, N. China, Chienshan, *Ross*, n. 466! Hupeh, *Henry*, n. 4075! 1788! 5922! Szechuen, *Henry*, n. 8806! 8994! *Wilson*, n. 3275! n. 4761! West Szechuen and Tibetan Frontier, at 9000–13,500 ft., *Pratt*, n. 101! Moupine, *David* fide *Franchet*.

Distinguished by its thin ovate leaves with slightly woolly veins and by its glabrous ovaries followed by unspotted fruit.

SECT. 3. **Maculatæ**, *Dunn*, sect. nov.

Folia sæpius glabra; ovarium cylindricum; bacca maculata.

8. A. CORIACEA, *Dunn*, sp. nov.; A. callosa, *Lindl.*, var. coriacea, *Finet et Gagn.*, *Fl. As. Or.* ii. (1907) 20. Frutex scandens, glaberrima, cortice rubido. Folia oblonga vel oblongo-ovata, plus minus remote mucronato-serrata vel apice grosse serrata, 10–16 cm. longa, crasse coriacea, subito acuminata, glandula stipitata sæpius terminata, basi cuneata, venis utrinque 6–7, haud prominentibus, petiolis 16–24 mm. longis. Flores polygami in cymis 1–4-floris axillaribus vel in ramis brevibus propriis racemose collectis dispositi, rubri vel rarius lutei, præter petala nonnunquam albo-marginata, fragrantes, bracteolis minutis; sepala 5, valde imbricata, ovata, 4–5 mm. longa; petala 5, rotundata, 7–8 mm. longa; antheræ luteæ; ovarium pubescens, cylindricum. Fructus cylindricus, maculatus, 10 mm. longus (unus tantum visus).

CHINA: Szechuen, cliffs near Kialing, *Wilson*, n. 3272! 3272 A! Mt. Omi, *Wilson*, n. 4760! *Faber*, at 3500 ft.! *Faber*, n. 72! E. Szechuen, *Farges*, n. 1546! N. Yunnan, Tchen Fong Shan, *Delavay*, n. 5152!

E. Pritzel's "*Actinidia*, sp. n.," in Diels, in Engl. Jahrb. xxix. (1900) 470, probably belongs here.

9. A. CALLOSA, *Lindl. Nat. Syst. Bot.* ed. 2 (1836) 439; *Dyer in Hook. f. Fl. Brit. Ind.* i. (1874) 286; *Hemsl. in Journ. Linn. Soc.* xxiii. (1886) 78; *Diels in Engl. Jahrb.* xxix. (1900) 470; *Matsum. et Hayata in Journ. Coll. Sci. Tokyo*, xxii. (1906) 47; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 324, f. 216.

From N. China and the Loochoo Islands to India, Burmah, and Java.

Var. 1. TYPICA. Folia glabra vel subglabra, basi sæpius cuneata.

Forma A. Forma Himalayana typica; folia chartacea glaberrima inferne pallida superne sæpius lucida sed nonnunquam majora, magis membranacea minus lucida, dentibus callosis regularibus approximatis, calyce glabro.

CHINA: Kiangsi, Kewkiang, *Bullock*, n. 127! Hupeh, *Henry*, n. 724 Szechuen, Mt. Omi, *Wilson*, n. 3273! Kwangtung, N. River, *Ford*, n. 115! Yunnan, *Henry*, n. 10056! 10056 A! 10056 B! 10824!

INDIA: Kumaon, *Strachey & Winterbotham*! *Falconer*, n. 305! Bootan, *Griffith*, n. 902! Nepal, *Wallich*, n. 6634! Sikkim, *Hooker*! *Edgeworth*, n. 273! *Clarke*, n. 26697! 26754! Burmah, *Collet*, n. 696!

JAVA, *Koorders*, n. 8210.

Forma B. Foliorum vena calycesque exigue tomentosi.

INDIA: Khasia, *Hooker*, n. 932! 1225!

Forma C. Foliorum vena in axillis tomentosa, calyces glabri.—A. curvidens, *Dunn in Kew Bull.* 1906, 1.; A. callosa, *Lindl.*, var. Henryi, *Maxim. in Act. Hort. Petrop.* xi. (1890) 36; *Finet et Gagn., Fl. As. Or.* ii. (1907) 19.

CHINA, Hupeh, *Henry*, n. 6617! 5797! 3471! 3494! 3564! 3955! Szechuen, S. Wushan, *Henry*, n. 7243! 5719! Tchen Kéou Tin, *Farges*! *Wilson*, n. 4762! 3269! Kweichow, *Bodinier* fide *Finet et Gagn.*

Forma D. Folia membranacea, ovata, acuminata, regulariter setaceo-serrata, venis inferne plus minus tomentosis; calyces tomentosi.

CHINA: Szechuen, *Pratt*, n. 101! *Wilson*, n. 3275! 4765! Yunnan, *Henry*, n. 10780!

Var. 2. SABIÆFOLIA, *Dunn*, var. nov. Folia basi cordata vel obtusa; flores 10 mm. diam. A. sabiæfolia, *Dunn in Journ. Linn. Soc. Bot.* xxxviii. (1908) 357.

CHINA: Fokien, *Hongkong Herb.* n. 2402!

Var. 3. TRICHOGYNE, *Finet et Gagn., Fl. As. Or.* ii. (1907) 20. Folia basi cordata vel obtusa, flores 20 mm. diam.

CHINA: Szechuen, *Farges*, n. 370!

Var. 4. FORMOSANA, *Finet et Gagn., Fl. As. Or.* ii. (1907) 20. Calyx tomentosus; foliorum venæ in axillis exigue tomentosæ.

CHINA: Formosa, *Henry*, n. 1388! *Ford*, n. 47!

Var. 5. PUBESCENS, *Dunn*, var. nov. Folia inferne conspicue pubescentia.

INDIA: Manipur, *Watt*, n. 6919!

MALAYA: Java, *ex Herb. Lugd.-Bat.* 1863!

Var. 6. PILOSULA, *Finet et Gagn., Fl. As. Or.* ii. (1907) 19. Folia basi truncata.

CHINA: Szechuen, Tsekou, *Soulié*, n. 1396! Yunnan, *Soulié*, fide *Finet et Gagn.*

The species may be distinguished by its yellow anthers, pubescent ovaries, and spotted fruits from its allies.

10. A. RUBRICAULIS, *Dunn in Kew Bull.* 1906, 2.

CHINA: Szechuen, Mt. Omi, *Wilson*, n. 4764! n. 3271! Yunnan, *Henry*, n. 10696! 11334!

Distinguished from *A. callosa* by its glabrous ovaries. Wilson notes that its flowers are rosy pink.

SECT. 4. **Vestitæ**, *Dunn*, sect. nov.

Caules novelli vel folia vel ambo villosi vel tomentosi.

11. A. CHAMPIONI, *Benth. Fl. Hongkong.* (1861) 26; *Hemsl. in Journ. Linn. Soc.* xxiii. (1886) 78; *Maxim. in Bull. Acad. Sci. St. Pétersb.* xxxi. (1886) 17; *Matsum. et Hayata in Journ. Coll. Sci. Tokyo*, xxii. (1906) 47; *Finet et Gagn., Fl. As. Or.* ii. (1907) 17.—A. Miquelii, *King in Journ. As. Soc. Beng.* lix. (1890) 196; *Ann. Bot. Gard. Calc.* v. (1896) t. 176.—Heptaca latifolia, *Gard. et Champ. in Hook. Kew Journ.* i. (1849) 243.—Kadsura pubescens, *Miq., Fl. Ind. Bat., Suppl.* (1860) 620.

CHINA: Formosa, fide *Matsum. et Hayata.* Kwangtung, Hongkong Is.! Lantao Is.! Hoifung!

INDO-CHINA, *Pierre*, n. 819!

MALAYA: Perak, *Ridley*, n. 5232! Perak, at 3500–4000 ft. *King's Collector*, n. 5437! 8789! Johore! Sumatra, fide *King.*

Var. MOLLIS, *Dunn*, var. nov. Folia inferne molliter albo-tomentosa.

CHINA: Yunnan, Szemao, *Henry*, n. 12041!

There does not appear to be any distinction at all to be drawn between *A. Championi* and *A. Miquelii*, which are therefore here treated as one species.

12. A. HOLOTRICHA, *Finet et Gagn., Fl. As. Or.* ii. (1907) 18, t. iii.; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 324.

CHINA: Yunnan, Outchay, *Delavay* fide *Finet et Gagn.*

13. A. STRIGOSA, *Hook. f. et Thoms. in Journ. Linn. Soc.* v. (1861) 55; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 324, f. 215.

INDIA: Sikkim, 6000–8000 ft., *Hooker*! *Gamble*, n. 28036! *Clarke*, n. 12431! *Kurz*! *Griffith*!

14. A. HEMSLEYANA, *Dunn in Journ. Linn. Soc., Bot.* xxxviii. (1908) 355.

CHINA: Fokien, in the upper valleys of the Yenping Mts., *Herb. Hongkong*, n. 2400!

15. A. HENRYI, *Dunn in Kew Bull.* 1906, 1, speciminibus, *Henry*, n. 11307 et 13335 omissis.

CHINA, Yunnan, Mengtze, *Henry*, n. 10381 ! 10381 A !

Since describing this species I have had opportunities of studying several species of this genus at various seasons in their natural condition, and am now of opinion that the fruiting and flowering specimens on which it was founded belong to two different species. I have therefore restricted the use of the above name to the species of which flowers and fruit were collected, describing the remaining fruiting specimens under the following number.

16. A. RUDIS, *Dunn*, sp. nov. Frutex alte scandens, caule dense strigoso tandem subglabro. Rami floriferi dense rubro-villosi, alii longi foliosi, alii brevissimi fructus solum gerentes. Folia ovata, dense ciliato-dentata, 12–14 cm. longa, chartacea, supra sparse infra dense strigosa, breviter acuminata. Florum pedunculi solitarii vel fasciculati, 18 mm. longi, tomentosi. Baccæ cylindricæ, tomentosæ, glabrescentes, maculatæ.

CHINA : Yunnan, *Henry*, n. 11307 ! 13335 !

17. A. DAVIDII, *Franch. in Nouv. Arch. Mus. Par.* sér. 2, v. (1884) 57 ; *Hemsl. in Journ. Linn. Soc., Bot.* xxiii. (1886) 78 ; *Finet et Gagn., Fl. As. Or.* ii. (1907) 18.

CHINA : E. Kiangsi, *David* fide *Franchet.*

18. A. LANCEOLATA, *Dunn in Journ. Linn. Soc., Bot.* xxxviii. (1908) 356.

CHINA : Fokien, hedges along the banks of the Min at Yenping, *Herb. Hongkong*, n. 2399 !

19. A. ERIANTHA, *Benth. in Journ. Linn. Soc.* v. (1861) 55 ; *Hemsl. in Journ. Linn. Soc.* xxiii. (1886) 78.

CHINA : "S. China, *Lindley*, 1836" !

20. A. CHINENSIS, *Planch. in Hook. Lond. Journ. Bot.* vi. (1847) 303 ; *Hemsl. in Journ. Linn. Soc.* xxiii. (1886) 78 ; *Diels in Engl. Jahrb.* xxix. (1900) 470 ; *Finet et Gagn., Fl. As. Or.* ii. (1907) 18 ; *Oliver in Hook. Ic. Pl.* t. 1593 (1887) ; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 323.

CHINA : N. China, *Fortune*, n. 35, fide *Finet et Gagn.* China, *Fortune*, n. 39 ! Shensi, *Giraldi* fide *Diels.* Hupeh, *Henry*, n. 1166 ! 1754 ! 2076 ! 5834 ! A ! B ! *Wilson*, n. 1031. Szechuen, *Wilson* ! *Pratt*, n. 721 ! Kweichow, *Bodinier* fide *Finet et Gagn.* Yunnan, *Ducloux* fide *Finet et Gagn.* Kwangtung, Macao, *Incarville*, circ. 1740, fide *Franchet.* Kwangsi, *Bourne*, 1897 !

Wilson notes that the Chinese names are *Yang-tao* or Strawberry Peach for the less hairy, *Mao Yang-tao* for the more hairy-fruited variety. The following observations made by this collector in the field are of interest. The leaves on the young shoots are cordately ovate acute ; the young shoots and the leaves on them are covered with reddish-crimson villose hairs. The pulp of the fruit is green, subacid, and very palatable, the flavour being like that of gooseberries.

21. A. LANATA, *Hemsl. in Ann. Bot.* ix. (1895) 146 ; *Dunn in Journ. Linn. Soc., Bot.* xxxviii. (1908) 355.

CHINA: Fokien, Shuikau, *Herb. Hongkong.* n. 2397! Kwangtung N.W. River, *Ford*, n. 228!

Distinguishable from *A. chinensis* by its tomentose shoots and by the closely hispidulous upper surface of the leaf.

22. A. FULVICOMA, *Hance in Journ. Bot.* xxiii. (1885) 321 ; *Hemsl. in Journ. Linn. Soc.* xxiii. (1886) 78 ; *Finet et Gagn., Fl. As. Or.* ii. (1907) 18 ; *C. K. Schneider, Ill. Handb. Laubholzk.* ii. (1909) 323.

CHINA: Kwangtung, Lo Fau Shan, *Ford*, 109! Kweichow, *Bodinier*, 2427!

The latter specimen is referred by Finet and Gagnepain to their variety *hirsuta* (Fl. As. Or. ii. 18). It is apparently from a secondary flowering branch and does not differ from the corresponding parts of Hance's type.

23. A. PACHYPHYLLA, *Dunn*, sp. nov. Frutex vagans. Caulis rufo-tomentosus, tandem subglaber. Folia oblonga, crebre setoso-dentata, 10–15 cm. longa, coriacissima, supra glabra, aspera, subtus dense et breviter pilis stellatis tomentosa, pallida nervis rufescentibus, apice acuta basi obtusa vel cordata, petiolis 24–36 mm. longis dense tomentosis. Cymæ masculæ novellæ (solum visæ) breves, dense tomentosæ, paucifloræ ; sepala 5, oblonga, barbata ; petala 5, rotundata.

CHINA: Swatow, Fung Wan Shan or Phœnix Mountain, *Hongkong Herb.*

SPECIES INCERTÆ SEDIS.

24. A. FORTUNATI, *Finet et Gagn. in Bull. Soc. Bot. Fr.* liii. (1906) 574.

CHINA: Kweichow, *Cavalerie et Fortunat*, fide *Finet et Gagn.*

In the absence of fruit or of female flowers it is not possible to decide into which of the three first sections it falls. Its long narrow cordate leaves distinguish it from all the other species here enumerated.

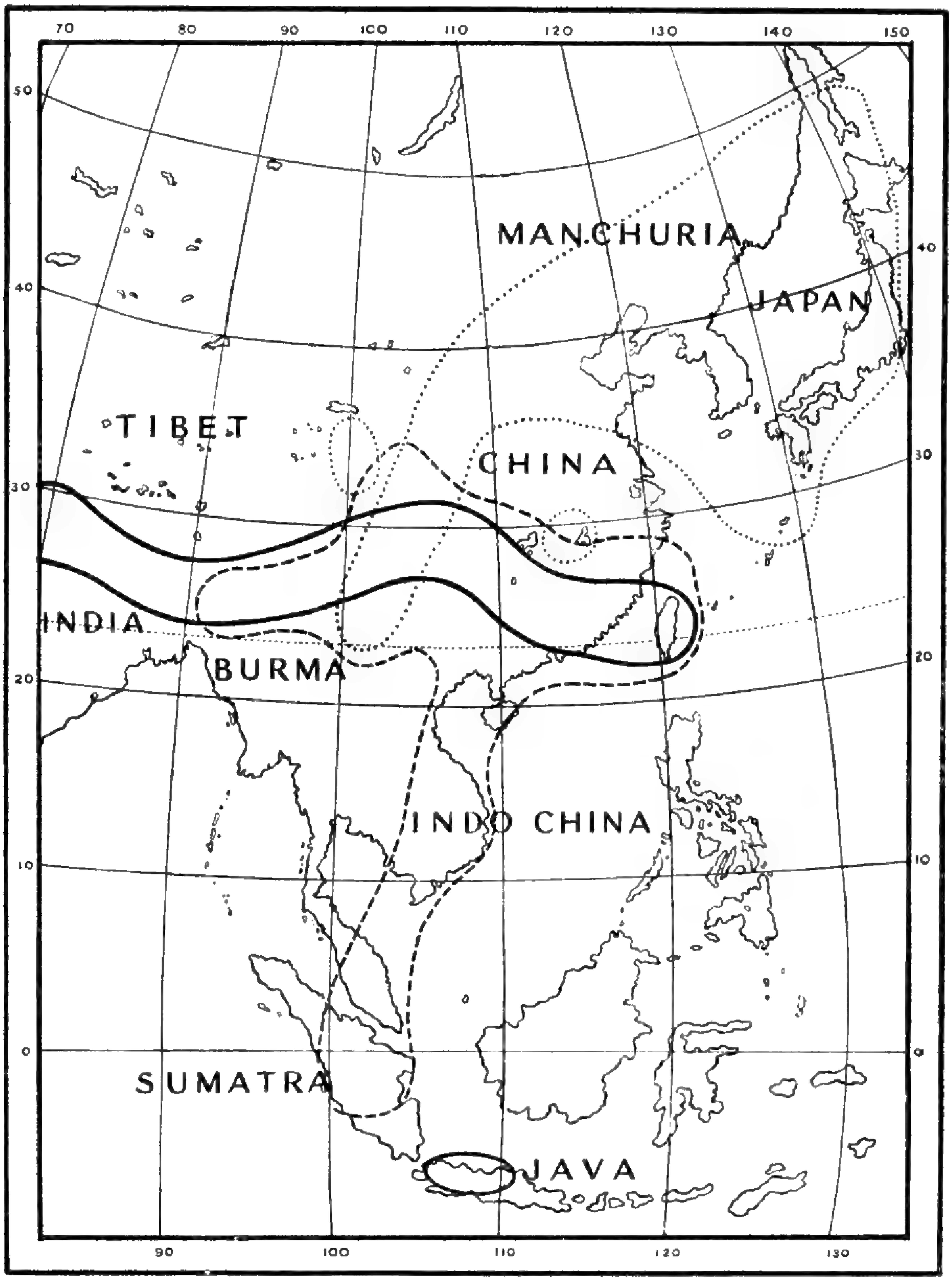
SPECIES EXCLUSÆ.

TROCHOSTIGMA REPANDA, *Sieb. et Zucc. in Abh. Akad. Wiss. Muench.* iii. (1843) 726 = Schizandra chinensis.

CLAVIS SPECIERUM.

1	Folia vel caules strigosi vel tomentosi	11
	Folia et caules glabri vel pubescentes	2
2	Ovarium ampulliforme, bacca immaculata	3
	Ovarium globosum vel cylindricum	8

3	Antheræ brunneæ vel atræ	4
	Antheræ flavæ	6
4	Foliorum plurium venæ haud setosæ	5
	Foliorum venæ regulariter setosæ	3. *Giraldii*, Diels.
5	Petalorum ungues brunnei	2. *rufa*, Miq.
	Petala tota viridula	1. *melanandra*, Franch.
6	Flores pentameri	4. *polygama*, Miq.
	Flores 2–4-meri	7
7	Sepala imbricata	5. *tetramera*, Maxim.
	Sepala valvata	6. *valvata*, Dunn.
8	Ovarium glabrum	9
	Ovarium pubescens, bacca maculata	10
9	Bacca maculata	10. *rubricaulis*, Dunn.
	Bacca immaculata	7. *Kolomicta*, Maxim.
10	Folia crasse coriacea	8. *coriacea*, Dunn.
	Folia chartacea vel membranacea	9. *callosa*, Lindl.
11	Folia stellato-tomentosa	12
	Folia pilis stellatis egentia	18
12	Pedunculi multiflori	11. *Championi*, Benth.
	Pedunculi pauciflori	13
13	Folia basi cuneata	18. *lanceolata*, Dunn.
	Folia cordata vel basi rotundata	14
14	Petioli quam 8 mm. breviores	19. *eriantha*, Benth.
	Petioli quam 12 mm. longiores	15
15	Folia oblonga	16
	Folia late ovata	17
16	Folia membranacea	22. *fulvicoma*, Hance.
	Folia coriacea	23. *pachyphylla*, Dunn.
17	Rami novelli setosi	20. *chinensis*, Planch.
	Rami novelli albo-tomentosi	21. *lanata*, Hemsl.
18	Folia matura glabra vel tenuiter hirsuta	19
	Folia dense hirsuta	22
19	Folia orbicularia	12. *holotricha*, Finet et Gagn.
	Folia oblongo-lanceolata	20
20	Folia subtus viridia	21
	Folia subtus glauca	15. *Henryi*, Dunn.
21	Rami perulati	13. *strigosa*, Hook. f. et Thoms.
	Remi eperulati	14. *Hemsleyana*, Dunn.
22	Folia strigosa	16. *rudis*, Dunn.
	Folia velutina	17. *Davidii*, Franch.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A SUPPLEMENTARY LIST OF CHINESE FLOWERING PLANTS, 1904–1910. By STEPHEN TROYTE DUNN, B.A., F.L.S., F.R.G.S., sometime Superintendent of the Botanical and Forestry Department, Hongkong, China.

[Read 2nd February, 1911.]

THE only complete enumeration of the flowering plants of China which has yet appeared began to be issued in this Journal in the year 1886 under the title of "An Enumeration of all the Plants known from China." Its author, Mr. Hemsley, pushed forward the work with all possible speed, but the vast amount of material, both in the herbarium and in the library, which had to be dealt with precluded its termination within the space or the time that was originally anticipated. It thus happened that by the time the enumeration was completed in 1904 a very large number of species had been discovered in China which were not to be found in the work. A list, therefore, prepared by Miss M. Smith, of the records of Chinese flowering plants, published between 1886 and March 1904 and not previously included in the "Enumeration," was issued with the concluding numbers of that work. The present compilation is intended to carry on that list up to the end of 1910, and it is planned on similar lines.

Like Miss Smith's list, it includes references to the places of publication of new species, as well as to records of the discovery in China of plants previously known only from other countries. With a few exceptions periodicals and other works published before March 1904 have not been exhaustively consulted, and any citations bearing dates previous to that year are supplementary to the list. It has been thought useful to add records of some 600 Chinese species, specimens of which have been determined by competent botanists, and are preserved in the Kew Herbarium though not previously notified in print. This portion of the list could have been very largely increased had time and opportunity permitted the consultation of other herbaria, especially those containing such large Chinese collections as are to be found at the British Museum, Paris, Berlin, and St. Petersburg.

Out of the 3500 citations of flowering plants, about 2000 are references to first publications of species, while some 700 refer to other published additions to the flora. It may be said, therefore, that at the present time new species are being published at the rate of about 300 a year and new records at about 100 a year.

In order to facilitate reference to the list such species as have appeared in the 'Index Kewensis' are quoted under the names adopted in that work, and if the binomials used in the publications quoted are different they are in all cases added in different type after the 'Index Kewensis' name. Where new species are published in synonymous genera cross-references are given.

The geographical area comprised is the same as that shown on the map published with the "Enumeration"—that is to say, the whole of China proper with Formosa, the Luchu Islands, the Corean Archipelago, Corea, S. Manchuria, the huge tract of half-desert country between the Nan Shan and the Altai ranges, and the Thibetan provinces of Batang and Litang. Whether the boundary thus indicated is the most natural that can be devised with the greatly increased knowledge of the flora of Asia which we now possess is a matter of doubt, but this would not be the place to attempt to revise it if such revision were desirable.

The period under notice has seen the commencement of an important descriptive Flora of the eastern watershed of Asia by Finet and Gagnepain *. It comprises nearly the whole of our area as well as the sub-arctic regions to the north-east and the enormous tracts of tropical forest in Cochin China and Siam to the south-west. In it is given for the first time a complete enumeration of the species collected by Delavay, Soulié, Farges, Bodinier, Ducloux, and the other great French collectors whose accumulated treasures in the Paris Museum Herbarium are hardly known to the world.

But perhaps the most encouraging feature of the last few years has been the rapidly growing botanical enterprise of the Japanese. Two elaborate enumerations of the Flora of Formosa have already appeared, while an equally full account of that of Corea is in progress.

The completion of Komarov's 'Flora of Manchuria' fills another gap in our knowledge of the vegetation of the northern boundaries, while further lists of plants sent by German collectors from Shantung and Shensi add to our scanty acquaintance with the Flora of the Northern Provinces of China proper. The Flora of Hupeh, already better known than that of most provinces, receives fresh elucidation through Pampanini's exhaustive list of the collections of Silvestri.

In South China the chief novelties have been published by Léveillé from collections made by French Missionaries in the extraordinarily rich mountain-ranges of Kweichau, while the botanical exploration of the South-Eastern Provinces has been continued from the botanical station established by the British Government at Hongkong.

The energy of the British collector, Mr. Augustine Henry, finds further recognition in this list by the publication of many hundred additional records for the Flora of Yunnan on the authority of his specimens in the Kew Herbarium. Both he and his fellow-countrymen, Messrs. E. H. Wilson and Forrest, have within recent years made enormous collections of splendid material in the wildest and least-explored regions of China, but only a small

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* "Contributions à la Flore de l'Asie Orientale," Mém. Soc. Bot. Fr. iv. (1905).

part of their discoveries has so far been examined. If the same amount of attention had been bestowed on them as has been given to some of the collections mentioned above, we should have had our knowledge of the Flora of the West and South-West of China enriched to an unparalleled extent.

I wish to acknowledge my indebtedness to Lieut.-Col. Prain for courteously allowing me to make full use of the library and herbarium of the Royal Botanic Gardens, Kew, during the completion of this work.

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  RECURVATA, Mast. in Journ. Linn. Soc., Bot. xxxvii. (1906) 423.
  SACHALINENSIS, Mast. *l. c.*
  SQUAMATA, Mast. in Gard. Chron. 1906, i. 299.

ABRUS PULCHELLUS, Wall.; Henry, n. 13,459, Herb. Kew.

ABUTILON MOLLE, Sweet; *Sida mollis*, Orteg., Pavol. in Nuov. Giorn. Bot. Ital. xv. (1908) 407.

ACACIA CÆSIA, Wight et Arn.; Henry, n. 9127, Herb. Kew.

ACALYPHA GIRALDII, Pamp. in Nuov. Giorn. Bot. Ital. xvii. (1910) 409.
  GRANDIS, Benth.; Matsum. et Hayata in Journ. Coll. Sci. Tokyo, xxii. (1906) 365.

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  GIRALDII, Harms, *l. c.*
  NODIFLORUM, Dunn in Journ. Bot. xlvii. (1909) 199.
  SIMONI, Simon-Louis ex C. K. Schneider, Ill. Handb. Laubholzk. ii. (1909) 427.

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  BUERGERIANUM, Rehder in Sargent, Trees and Shrubs, i. (1905) 180.
  CÆSIUM, Wall.; Rehder, *l. c.* 179.
  CAMPBELLII, Hook. f. et Thoms.; Rehder, *l. c.*
  FARGESI, Rehder, *l. c.* 180.
  FLABELLATUM, Rehder, *l. c.* 161.
  GRISEUM, Pax; Rehder, *l. c.* 181.
  LÆTUM, C. A. Mey.; Rehder, *l. c.* 177.
  LONGIPES, Rehder, *l. c.* 178.
  MANSHURICUM, Maxim.; Kom. in Act. Hort. Petrop. xxii. (1904) 727

Acer Pavolinii, Pamp. in Nuov. Giorn. Bot. Ital. xvii. (1910) 422.

pseudo-sieboldianum, Kom. in Act. Hort. Petrop. xxii. (1904) 725.

sikkimense, Miq.; Rehder in Sargent, Trees and Shrubs, i. (1905) 180.

stachyophyllum, Hiern; Pax in Engl. Pflanzenreich, Acerac. (1902) 34.

tegmentosum, Maxim.; Kom. in Act. Hort. Petrop. xxii. (1904) 733.

Tschonoskii, Maxim.; Kom. *l. c.* 735.

Tutcheri, Duthie in Kew Bull. 1908, 16.

Wilsoni, Rehder in Sargent, Trees and Shrubs, i. (1905) 157.

Achillea cartilaginea, Ledeb.; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 104.

Ptarmica, Linn.; Kom. in Act. Hort. Petrop. xxv. (1907) 636.

Aconitum cannabifolium, Franch. ex Finet et Gagn., Fl. As. Or. i. (1905) 200.

Cavaleriei, Léveillé et Vaniot in Bull. Soc. Agr. Sarthe, 1905, 78.

contortum, Finet et Gagn. in Bull. Soc. Bot. Fr. li. (1904) 506.

coreanum, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 101.

coriaceum, Léveillé, *l. c.* 257.

divaricatum, Finet et Gagn. in Bull. Soc. Bot. Fr. li. (1904) 511.

Duclouxii, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 99.

Forrestii, Stapf in Kew Bull. 1910, 19.

Franchetii, Finet et Gagn. in Bull. Soc. Bot. Fr. li. (1904) 510.

jaluense, Kom. in Act. Hort. Petrop. xxii. (1903) 257.

koreanum, Nakai in Journ. Coll. Sci. Tokyo, xxvi. i. (1909) 31.

longecassidatum, Nakai, *l. c.* 27.

macrorhynchum, Turcz.; Kom. in Act. Hort. Petrop. xxii. (1903) 258.

napiforme, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. v. (1908) 9.

Souliei, Finet et Gagn. in Bull. Soc. Bot. Fr. li. (1904) 515.

stylosum, Stapf in Kew Bull. 1910, 20.

tatsienense, Finet et Gagn. *l. c.* 510.

Uchiyamai, Nakai in Journ. Coll. Sci. Tokyo, xxvi. i. (1909) 31.

umbrosum, Kom. in Act. Hort. Petrop. xxii. (1903) 250.

uncinatum, L.; Finet et Gagn., Fl. As. Or. i. (1905) 204.

villosum, Reichb.; Finet et Gagn. *l. c.* 203.

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palustris, Kom. ; Kom. in Act. Hort. Petrop. xxv. (1907) 558.

polyantha, Nakai in Bot. Mag. Tokyo, xxiii. (1909) 188.

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sessilifolia, Benth. et Hook. f. ; Henry, n. 928, Herb. Kew.

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Æchmanthera tomentosa, Nees ; Henry, n. 10,033, Herb. Kew.

Æschynanthus grandiflora, Spreng. ; Henry, n. 12,637, Herb. Kew.

longicaulis, Wall. ; Henry, n. 10,877, Herb. Kew.

superba, C. B. Clarke ; Henry, n. 12,533, Herb. Kew.

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Agrostis Clarkei, Hook. f. ; Hayata in Journ. Coll. Sci. Tokyo, xxv. xix. (1908) 237.

Ailanthus Giraldii, Dode in Bull. Soc. Dendr. Fr. 1907, 191.

sutchuensis, Dode, *l. c.* 193.

Vilmoriniana, Dode in Rév. Hortic. 1904, 444.

Ainsliæa apiculata, Sch. Bip. ; Wilson, n. 2743, Herb. Kew.

aptera, DC. ; Henry, n. 9907 a, Herb. Kew.

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liukiuensis, Beauverd, *l. c.*

macroclinidioides, Hayata in Journ. Coll. Sci. Tokyo, xxv. xix. (1908) 141.

morrisonicola, Hayata, *l. c.* 142.

Ainsliæa reflexa, Merrill ; Hayata, in Journ. Coll. Sci. Tokyo, xxv. xix. *l. c.* (1908) 143.

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Aleurites Fordii, Hemsl. in Hook. Ic. Pl. t. 2801 (1906).

Alisma coreana, Léveillé in Fedde, Repert. Nov. Sp. viii. (1910) 286.

Alkanna tinctoria, Tausch. ; Gilg u. Loes. in Engl. Jahrb. xxxiv. Beibl. 75 (1904) 61.

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Hugonianum, Rendle in Journ. Bot. xliv. (1906) 44.

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macranthum, Baker ; Bulley, Herb. Kew.

Mairei, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 384.

platyspathum, Schrenk ; Przewalski, 1872–3, Kerb. Kew.

platystylum, Regel ; Przewalski, 1879, Herb. Kew.

Martini, Léveillé et Vaniot in Mem. Accad. Rom. Nuov. Linc. xxiii. (1906) 368.

oviflorum, Regel ; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 21.

plurifoliatum, Rendle in Journ. Bot. xliv. (1906) 43.

Schœnoprasum, Linn. ; Forrest, n. 914, Herb. Kew.

strictum, Schrad ; *A. Szovitsi*, Regel, Przewalski, 1879, Herb. Kew.

Taqueti, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. v. (1908) 283.

tchongchanense, Léveillé in Fedde, Repert. Nov. Sp. vi. (1909) 263.

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Alphonsea lutea, Hook. f. et Thoms. ; Morse, n. 482, Herb. Kew.
Alpinia blepharocalyx, K. Schumann in Engl. Pflanzenreich, Zingib. (1904) 334.
hainanensis, K. Schumann, *l. c.* 335.
Henryi, K. Schumann, *l. c.*
intermedia, Gagnep. in Bull. Soc. Bot. Fr. xlviii. (1902) lxxxiii.
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Alstonia scholaris, R. Br. ; Morse, n. 159, Herb. Kew.
Altingia gracilipes, Hemsl. in Hook. Ic. Pl. (1907) t. 2837.
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myriophylloides, Dunn in Journ. Bot. xlvii. (1909) 199.
salicifolia, Monti ; Henry, n. 9493, Herb. Kew.
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contorta, Hook. f. ; Hosie, 1904, Herb. Kew.
lactea, Maxim. ; Potanin, 1885, Herb. Kew.
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oblonga, DC. ; Matsum. et Hayata in Journ. Coll. Sci. Tokyo, xxii. (1906) 210.
triplinervis, Sims ; Wilson, n. 4988, Herb. Kew.
viridis, Cummins in Kew. Bull. 1908, 19.
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erecta, Maxim. ; Knuth in Engl. Pflanzenreich, Primul. (1905) 209.
geraniifolia, Watt ; Knuth, *l. c.* 174.
Hookeriana, Klatt ; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 85.
mucronifolia, Watt ; Knuth in Engl. Pflanzenreich, Primul. (1905) 188.
Paxiana, Knuth, *l. c.* 176.
Prattiana, Knuth, *l. c.* 184.

Androsace sarmentosa, Wall.; Knuth in Engl. Pflanzenreich, Primul. (1905) 183.

spinulifera, Knuth, *l. c.* 184.

tibetica, Knuth, *l. c.* 187.

Aneilema Bodinieri, Léveillé et Vaniot in Mém. Soc. Sci. Nat. Cherb. xxxv. (1906) 389.

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coreanum, Léveillé et Vaniot, *l. c.* 390.

Taquetii, Léveillé in Fedde, Repert. Nov. Sp. viii. (1910) 284.

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batangensis, Finet in Journ. de Bot. xxi. (1908) 30.

Bonatiana, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 98.

dahurica, Fisch.; Kom. in Act. Hort. Petrop. xxii. (1903) 273.

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Esquirolii, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 58.

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nemorosa, L.; Finet in Journ. de Bot. xxi. (1908) 29.

Prattii, Huth ex Ulbr. in Engl. Jahrb. xxxvi. Beibl. 80 (1905) 4.

rupicola, Camb.; Finet in Journ. de Bot. xxi. (1908) 29.

saniculifolia, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 383.

Siuzevi, Kom. in Act. Hort. Petrop. xxv. (1907) 814.

stolonifera, Maxim.; Ulbr. in Engl. Jahrb. xxxvii. (1905) 233.

tetrasepala, Royle; Faber, n. 258, Herb. Kew.

trullifolia, Hook. f. et Thoms.; Finet in Journ. de Bot. xxi. (1908) 29.

Ulbrichiana, Diels in Ulbr. in Engl. Jahrb. xxxvi. Beibl. 80 (1905) 4.

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formosana, Boissieu in Bull. Soc. Bot. Fr. lvi. (1909) 354.

Maximowiczii, Benth.; Kom. in Act. Hort. Petrop. xxv. (1905) 163.

pubescens, Maxim.; Henry, n. 7363, Herb. Kew.

Anisodus Mariæ, Pascher in Fedde, Repert. Nov. Sp. vii. (1909) 227.

Anisopappus candelabrum, Léveillé in Fedde, *l. c.* viii. (1910) 451.

Annesleya fragrans, Wall.; Henry, n. 11,591 c, Herb. Kew.

Anotis chrysotricha, Palibin in Bull. Herb. Boiss. sér. 2, vi. (1906) 20.

Antennaria sarawschanica, Trautv. et Regel; Wilson, n. 3822, Herb. Kew.

Steetziana, Turcz.; Bretschneider, n. 375, Herb. Kew.

Anthemis arvensis, Linn.; Kom. in Act. Hort. Petrop. xxv. (1907) 641.

Cotula, Linn.; Maingay, n. 625, Herb. Kew.

Apios carnea, Benth.; Pamp. in Nuov. Giorn. Bot. Ital. xvii. (1910) 5.

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VENTRICOSUM, Boissieu in Bull. Soc. Bot. Fr. liii. (1906) 425.

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ARABIS ALASHANICA, Maxim. ; Maxim. in Act. Hort. Petrop. xi. (1890) 50.

ALPINA, Linn. ; Hayata in Journ. Coll. Sci. Tokyo, xxv. XIX. (1908) 49

ARVENSIS, Edgew. ; *A. taraxacifolia*, Anders., Hayata, *l. c.* 50.

GLANDULOSA, Kar. et Ker. ; Przewalski, 1880, Herb. Kew.

ARALIA BIPINNATIFIDA, C. B. Clarke ; Henry, n. 6834, Herb. Kew.

CORDATA, Thunb. ; Kom. in Act. Hort. Petrop. xxv. (1905) 125.

FOLIOSA, Seem. ; Henry, n. 12,711, Herb. Kew.

THOMSONI, Seem. ; Henry, n. 9479 A, Herb. Kew.

ARDISIA CORNUDENTATA, Mez in Engl. Pflanzenreich, Myrsin. (1902) 144.

DEPRESSA, C. B. Clarke ; Henry, n. 9653, Herb. Kew.

GIGANTIFOLIA, Stapf in Kew Bull. 1906, 74.

HORTORUM, Maxim. ; Matsum. et Hayata in Journ. Coll. Sci. Tokyo, xxii. (1906) 227.

LANCEOLATA, Roxb. ; Henry, n. 13,773, Herb. Kew.

ODONTOPHYLLA, Wall. ; Henry, n. 12,021 A, Herb. Kew.

OLDHAMI, Mez in Engl. Pflanzenreich, Myrsin. (1902) 148.

VILLOSA, Roxb. ; *A. vestita*, Wall., Mez, *l. c.* 141.

VIRENS, Kurz ; Henry, n. 13, 578, Herb. Kew.

ARENARIA MUSCIFORMIS, Wall. ; Przewalski, 1884, Herb. Kew.

ARGOSTEMMA VERTICILLATUM, Wall. ; Henry, n. 13,122 A, Herb. Kew.

ARGYREIA SPLENDENS, Sweet ; Henry, n. 10,537 A, Herb. Kew.

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WALLICHII, Choisy ; Henry, n. 12,511, Herb. Kew.

ARISÆMA BREVIPES, Engl. in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 11.

ENGLERI, Pamp. in Nuov. Giorn. Bot. Ital. xvii. (1910) 236.

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  - stricta, Edgew. ; Delavay, n. 2299, Herb. Kew.
  - stolonifera, Maxim. ex Kom. in Act. Hort. Petrop. xxv. (1907) 676.
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  - virescens, Hutchinson in Kew Bull. 1908, 16.
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  - Harmsii, Ulbr. *l. c.* 63.
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  - leansanicus, Ulbr. *l. c.* 62.
  - longispicatus, Ulbr. *l. c.* 61.
  - membranaceus, Bunge ; Kom. in Act. Hort. Petrop. xxii. (1904) 586.
  - Stevenianus, DC. ; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 63.
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Korshinskii, Kom. *l. c.* 351.

Leveillei, Kom. *l. c.* 207.

Maximovicziana, Kom. *l. c.* 269.

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Roborvskyi, Kom. *l. c.* 280.

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Cardiandra formosana, Hayata in Bot. Mag. Tokyo, xx. (1906) 54.

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alpina, Sw.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 384.

appendiculata, Kükenth.; Kükenth. *l. c.* 338.

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AUGUSTINOWICZII, Meinsh.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 389.

BLINII, Léveillé et Vaniot in Bull. Soc. Bot. Fr. liii. (1906) 316, et Kükenth. *l. c.* 639.

BOTRYCHOSTIGMA, Maxim.; Kükenth. *l. c.* 595.

CARYOPHYLLEA, Latour.; Kükenth. *l. c.* 463.

CAVALERIEI, Léveillé et Vaniot in Bull. Soc. Agr. Sarthe, 1905, 79, et Kükenth. *l. c.* 635, sub *C. laticepite*, C. B. Clarke.

CAVALERIENSIS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. iii. (1907) 349.

CHORDA, Léveille et Vaniot in Bull. Soc. Bot. Fr. liii. (1906) 316.

CHRYSOLEPIS, Franch.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 564.

CINCTA, Franch.; Kükenth. *l. c.* 353.

CRASSIBASIS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. v. (1908) 194.

CURVICOLLIS, Franch. et Sav.; Léveillé in Bull. Soc. Bot. Fr. liii. (1906) 318.

CUSPIDOSA, Dunn in Journ. Linn. Soc., Bot. xxxviii. (1908) 373.

DEBEAUXII, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. vi. (1909) 264.

DIAMANTINA, Léveillé et Vaniot, *l. c.* iv. (1907) 226.

DRYMOPHILA, Turcz.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 755.

DUNNIANA, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 231.

EGENA, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. iv. (1907) 227.

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ESQUIROLII, Léveillé et Vaniot in Bull. Soc. Bot. Fr. liii. (1906) 315.

EXPLENS, Kükenth. in Bull. Herb. Boiss. sér. 2, ii. (1902) 1017, et in Engl. Pflanzenreich, Cyper.-Caric. (1909) 593, sub *C. botrychostigmate*, Maxim.

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GENDREI, Léveillé et Vaniot in Rev. Sci. Limousin, 1904, ex Kükenth. *l. c.* 625, sub *chinensi*, Retz., et ex Mém. Soc. Sci. Nat. Cherb. xxxv. (1905) 216 (sphalm. *Legendrei*).

GIFUENSIS, Franch.; Kükenth. *l. c.* 442.

GIRALDIANA, Kükenth. in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 10.

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GLOBULARIS, Linn.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 437.

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GRANDILIGULATA, Kükenth. in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 9.

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HÆMOSTACHYS, Léveillé et Vaniot ex Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 741, sub *heterostachyi*, Bunge.

HALLAISANENSIS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. v. (1908) 240.

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HEBECARPA, C. A. Mey.; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 11.

HEUDESII, Léveillé ex Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 626.

HONGNOENSIS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 426.

IDZUROEI, Franch.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 708.

INDISTINCTUM, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. v. (1908) 194.

KOREANA, Kom. in Act. Hort. Petrop. xx. (1901) 446.

LANCEOLATA, Boott; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 8.

LASIOCARPA, Ehrenb.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 747.

LASIOLEPIS, Franch.; Kükenth. *l. c.* 486.

LATITANS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. v. (1908) 240.

LIMOSA, Linn.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 505.

LOLIACEA, Linn.; Kükenth. *l. c.* 225.

LONGEROSTRATA, C. A. Mey.; Kükenth. *l. c.* 636.

LYI, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. iii. (1907) 349.

MAACKII, Maxim.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 201.

MACRANDROLEPIS, Léveillé in Fedde, Repert. Nov. Sp. v. (1908) 241.

MACROGYNA, Turcz.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 560.

MANDSHURICA, Meinsh.; Kükenth. *l. c.* 434.

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Meyeriana, Kunth; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 393.

micrantha, Kükenth. in Bull. Herb. Boiss. sér. 2, ii. (1902) 1018.

mitrata, Franch.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 471.

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Onoei, Franch. et Sav.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 101.

orbicularis, Boott; Kükenth. *l. c.* 303.

pallida, C. A. Mey.; Kükenth. *l. c.* 134.

papulosa, Boott; Kükenth. *l. c.* 637.

paucimascula, Léveillé et Vaniot in Bull. Soc. Bot. Fr. liii. (1906) 315.

Paxii, Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 765.

Peiktusani, Kom. in Act. Hort. Petrop. xx. (1901) 445.

pilosa, Scop.; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 636.

planiculmis, Kom.; Kükenth. *l. c.* 621.

platyrhyncha, Franch. et Sav.; Gilg et Loes. in Engl. Jahrb. xxxiv. Beibl. 75 (1904) 22.

pseudochinensis, Léveillé et Vaniot ex Kükenth. in Engl. Planzenreich, Cyper.-Caric. (1909) 737.

pseudospachiana, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. iii. (1907) 349.

psychrophila, Nees; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 539.

radiciflora, Dunn in Journ. Linn. Soc., Bot. xxxviii. (1908) 371.

rara, Boott; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 102.

Reichenbachiana, Léveillé et Vaniot in Bull. Acad. Géogr. Bot. xi. (1902) 60, et Kükenth. *l. c.* 345, sub *rubrobrunnea*, C. B. Clarke.

rivulorum, Dunn in Journ. Linn. Soc., Bot. xxxviii. (1908) 372.

scabrirostris, Kükenth. in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 9.

schistorhyncha, Léveillé et Vaniot in Bull. Soc. Bot. Fr. liii. (1906) 317.

Schkuriana, Léveillé et Vaniot in Bull. Acad. Géogr. Bot. xi. (1902) 59, ex Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 354, sub *cernua*, Boott.

Schmidtii, Meinsh.; Kükenth. *l. c.* 326.

Sedakovii, C. A. Mey.; Kükenth. *l. c.* 588.

setigera, D. Don; Kükenth. *l. c.* 419.

CAREX SETOSA, Boott ; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 564.

SILVESTRII, Pamp. in Nuov. Giorn. Bot. Ital. n. s. xvii. (1910) 235.

SPARSIFLORA, Steud. ; Kükenth. in Engl. Planzenreich, Cyper.-Caric. (1909) 511.

SUPINA, Wahlenb. ; Kükenth. *l. c.* 455.

TAQUETII, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 426.

TATSIENSIS, Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 563.

TEIOGYNA, Boott ; Kükenth. *l. c.* 602.

TENUIFORMIS, Léveillé et Vaniot ; Kükenth. *l. c.* 571.

TRICARINATA, Léveillé et Vaniot in Bull. Soc. Bot. Fr. liii. (1906) 317.

TUMINENSIS, Kom. ; Kükenth. *l. c.* 369.

UDA, Maxim. ; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 103.

UMBROSA, Host ; Kükenth. *l. c.* 466.

WARBURGIANA, Kükenth. in Bull. Herb. Boiss. sér. 2, v. (1905) 1162.

XIPHIUM, Kom. ; Kükenth. in Engl. Pflanzenreich, Cyper.-Caric. (1909) 636.

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CARISSA SPINARUM, Linn. ; Henry, n. 10,156 A, Herb. Kew.

CAROLINELLA OBOVATA, Hemsl. in Hook. Ic. Pl. sub t. 2775 (1903).

CARPESIUM ACUTUM, Hayata in Journ. Coll. Sci. Tokyo, xxv. XIX. (1908) 133.

DIVARICATUM, Sieb. et Zucc. ; Kom. in Act. Hort. Petrop. xxv. (1907) 618.

ERYTHROLEPIS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 170.

GIGAS, Léveillé in Fedde, Repert. Nov. Sp. vi. (1909) 330.

HIERACIOIDES, Léveillé, *l. c.* viii. (1910) 170.

HONTONENSE, Winkl. ; Potanin, 1885, Herb. Kew.

POTANINI, Winkl. ; Potanin, 1885, Herb. Kew.

TAQUETII, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 170.

VERBASCIFOLIUM, Léveillé et Vaniot, *l. c.* 359.

CARPINUS LONDONIANA, Winkl. in Engl. Pflanzenreich, Betul. (1904) 32.

PAXII, Winkl. *l. c.* 35.

PINFAENSIS, Léveillé et Vaniot in Bull. Soc. Bot. Fr. lii. (1905) 142.

STIPULATA, Winkl. in Engl. Pflanzenreich, Betul. (1904) 35.

TSCHONOSKII, Maxim. ; Winkl. *l. c.* 36.

CARUM ANTHRISCOIDES, Boissieu in Bull. Soc. Bot. Fr. liii. (1906) 426.

CARYOPTERIS PANICULATA, C. B. Clarke ; Henry, n. 10,408, Herb. Kew.

CASSIA NODOSA, Buch.-Ham. ; Henry, n. 11,725 C, Herb. Kew.

SIAMEA, Lam. ; Henry, n. 13,172, Herb. Kew.

Castanea Bodinieri, Léveillé et Vaniot in Bull. Soc. Bot. Fr. lii. (1905) 142.
  Davidii, Dode in Bull. Soc. Dendr. Fr. 1908, 153.
  Duclouxii, Dode, *l. c.* 150.
  Fargesii, Dode, *l. c.* 158.
  hupehensis, Dode, *l. c.* 151.
  Seguinii, Dode, *l. c.* 152.
  Vilmoriniana, Dode, *l. c.* 156.
Castanopsis Eyrei, Tutcher in Journ. Linn. Soc., Bot. xxxvii. (1905) 68.
  indica, A. DC.; Hayata in Journ. Coll. Sci. Tokyo, xxv. xix. (1908) 204.
  taiwaniana, Hayata, *l. c.* 205.
Catalpa Duclouxii, Dode in Bull. Soc. Dendr. Fr. 1907, 201.
  Henryi, Dode, *l. c.* 199.
  sutchuensis, Dode, *l. c.* 204.
Caucalis scabra, Makino; Boissieu in Bull. Soc. Bot. Fr. lvii. (1910) 413.
Celastrus clemacanthus, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 284.
Celtis Biondii, Pamp. in Nuov. Giorn. Bot. Ital. xvii. (1910) 252.
  koraiensis, Nakai in Bot. Mag. Tokyo, xxiii. (1909) 191.
Centaurea Cyanus, L.; Gilg et Loes. in Engl. Jahrb. xxxiv. Beibl. 75 (1904) 75.
  missionis, Léveillé in Fedde, Repert. Nov. Sp. viii. (1910) 451.
Centranthera grandiflora, Benth.; Henry, n. 9019, Herb. Kew.
Cephalotaxus Griffithii, Hook. f.; Mast. in Journ. Bot. xli. (1903) 269.
Cerastium glomeratum, Thuill.; *C. vulgatum*, Linn., Carles, n. 263, Herb. Kew.
  morrisonense, Hayata in Journ. Coll. Sci. Tokyo, xxv. xix. (1908) 57.
  trigynum, Vill.; James, 1886, Herb. Kew.
  Wilsoni, Takeda in Kew Bull. 1910, 381.
Ceratostigma minus, Stapf ex Prain in Journ. Bot. xliv. (1906) 7.
Cercidiphyllum japonicum, Sieb. et Zucc.; Finet et Gagn., Fl. As. Or. i. (1907) 26.
Cercis glabra, Pamp. in Nuov. Giorn. Bot. Ital. n. s. xvii. (1910) 393.
Chærophyllum Huai, Boissieu in Bull. Soc. Bot. Fr. lvi. (1909) 354.
  villosum, Wall.; Henry, n. 10,294, Herb. Kew.
Chailletia gelonioides, Hook. f.; Henry, n. 12,692, Herb. Kew.
Chamærodos sabulosa, Bunge; Przewalski, n. 458, Herb. Kew.
Chelonopsis Giraldii, Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 94.
Chenopodium murale, Linn.; Pamp. in Nuov. Giorn. Bot. Ital. n. s. xvii. (1910) 262.
Chickrassia tabularis, A. Juss.; Henry, n. 8149, Herb. Kew.
Chimaphila astyla, Maxim.; Wilson, n. 1375, Herb. Kew.

Chionanthus coreanus, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 280.

Chirita Chaneti, Léveillé in Bull. Acad. Géogr. Bot. xvii. (1907) iii.

dimidiata, R. Br.; Henry, n. 13,438, Herb. Kew.

hamosa, R. Br.; Henry, n. 12,443, Herb. Kew.

pumila, D. Don; Henry, n. 12,281, Herb. Kew.

sericea, Léveillé et Vaniot in Compt. Rend. Assoc. Fr. 1905 (1906) 428.

speciosa, Kurz; Henry, n. 11,789, Herb. Kew.

sphagnicola, Léveillé et Vaniot in Bull. Soc. Bot. Fr. liii. (1906) 550.

urticæfolia, Buch.-Ham.; Henry, n. 9161, Herb. Kew.

Chisocheton hongkongensis, Tutcher in Journ. Linn. Soc., Bot. xxxvii. (1905) 64.

Chrysanthemum hypargyreum, Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 104.

lineare, Matsum.; Kom. in Act. Hort. Petrop. xxv. (1907) 643.

naktongense, Nakai in Bot. Mag. Tokyo, xxiii. (1909) 186.

Chrysosplenium Biondianum, Engl. in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 50.

chamædryoides, Engl. *l. c.*

Giraldianum, Engl. *l. c.* 49.

pseudo-Faurei, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 282.

Cinna arundinacea, Linn.; *C. pendula*, Trin.; Kom. in Act. Hort. Petrop. xx. (1901) 274.

Circæa coreana, Léveillé in Fedde, Repert. Nov. Sp. iv. (1907) 226.

Delavayi, Léveillé, *l. c.* viii. (1910) 138.

Circæaster agrestis, Maxim.; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 39.

Cissampelos Pareira, Linn.; Henry, n. 9532, Herb. Kew.

Cladrastis amurensis, Benth.; Gilg et Loes. in Engl. Jahrb. xxxiv. Beibl. 75 (1904) 42.

Fortunei, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 230.

Tashiroi, Yatabe; Ito et Matsum. in Journ. Coll. Sci. Tokyo, xii. iv. (1900) 169.

Clausena excavata, Burm. f.; Matsum. et Hayata in Journ. Coll. Sci. Tokyo, xxii. (1906) 75.

Willdenowii, Wright et Arn.; Henry, n. 13,028, Herb. Kew.

Cleidion javanicum, Blume; Tutcher in Journ. Linn. Soc. xxxvii. (1905) 67.

Clematis acuminata, DC.; Henry, n. 11,586 a, Herb. Kew.

acutangula, Hook. f. et Thoms.; Henry, n. 9292 a, Herb. Kew.

Biondiana, Pavol. in Bull. Soc. Tosc. Ort. xxxii. (1907) 285.

Clematis connata, DC.; Matsum. et Hayata in Journ. Coll. Sci. Tokyo, xxii. (1906) 6.
dioscoreifolia, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. vii. (1909) 339.
Duclouxii, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 97.
Esquirolii, Léveillé et Vaniot in Bull. Herb. Boiss. sér. 2, vi. (1906) 504.
Faberi, Hemsl. et E. H. Wils. in Kew Bull. 1906, 148.
filamentosa, Dunn in Journ. Bot. xlvii. (1909) 197.
Finetiana, Léveillé et Vaniot in Bull. Soc. Bot. Fr. li. (1904) 219.
florida, Thunb. ; Finet et Gagn. in Bull. Soc. Bot. Fr. l. (1904) 553.
Gagnepainiana, Léveillé et Vaniot in Bull. Soc. Bot. Fr. li. (1904) 219.
hastata, Finet et Gagn. in Bull. Soc. Bot. Fr. l. (1904) 527.
hupehensis, Hemsl. et E. H. Wils. in Kew Bull. 1906, 148.
Lechenaultiana, DC. ; Finet et Gagn. in Bull. Soc. Bot. Fr. l. (1904) 542.
longisepala, Hayata in Journ. Coll. Sci. Tokyo, xxv. xix. (1908) 41.
Mairei, Léveillé, in Fedde, Repert. Nov. Sp. vii. (1909) 337.
Martini, Léveillé in Bull. Acad. Géogr. Bot. xvii (1907) ii.
Morii, Hayata in Journ. Coll. Sci. Tokyo, xxv. xix. (1908) 42.
ochotensis, Poir. ; Kom. in Act. Hort. Petrop. xxii. (1903) 276.
oligocarpa, Léveillé in Bull. Acad. Géogr. Bot. xvii. (1907) ii.
otophora, Franch. ex Finet et Gagn. in Bull. Soc. Bot. Fr. l. (1904) 548.
patens, Morr. et Decne. ; Finet et Gagn., Fl. As. Or. i. (1905) 37.
Pavoliniana, Pamp. in Nuov. Giorn. Bot. Ital. n. s. xvii. (1910) 270.
Pierotii, Miq. ; Finet et Gagn., Fl. As. Or. i. (1905) 19.
pseudopogonandra, Finet et Gagn. in Bull. Soc. Bot. Fr. l. (1904) 549.
quinquefoliolata, Hutchinson in Gard. Chron. 1907, i. 3.
repens, Finet et Gagn. in Bull. Soc. Bot. Fr. l. (1904) 548.
serratifolia, Rehder in Mitth. Dendr. Gesellsch. 1910, 248.
smilacifolia, Wall. ; Henry, n. 12,766 b, Herb. Kew.
songorica, Bunge ; Roborowski, 1889, Herb. Kew.
tibetana, O. Kuntze ; Henry, n. 9326, Herb. Kew.
tozanensis, Hayata in Journ. Coll. Sci. Tokyo, xxv. xix. (1908) 42.
trullifera, Finet et Gagn. in Bull. Soc. Bot. Fr. l. (1904) 547.
Williamsii, Finet et Gagn. Fl. As. Or. i. (1905) 11.
Clematoclethra disticha, Hemsl. in Hook. Ic. Pl. sub t. 2808 (1906).
Francheti, Kom. in Act. Hort. Petrop. xxix. (1908) 94.
grandis, Hemsl. in Hook. Ic. Pl. sub t. 2808 (1906).
Prattii, Kom. in Act. Hort. Petrop. xxix. (1908) 95.
tiliacea, Kom. *l. c.* 91.
Wilsoni, Hemsl. in Hook. Ic. Pl. sub t. 2808 (1906).

CLERODENDRON COLEBROOKIANUM, Walp.; Henry, n. 12,421, Herb. Kew.
  FARGESII, Dode in Bull. Soc. Dendr. Fr. 1907, 207.
  SCAPOSUM, Hemsl. in Hook. Ic. Pl. t. 2675 (1900).
  SERRATUM, Spreng.; Henry, n. 10,077 B, Herb. Kew.
  VILLOSUM, Blume; Wilson, n. 1587, Herb. Kew.
CLETHRA BARBINERVIS, Sieb. et Zucc.; Gilg et Loes. in Engl. Jahrb. xxxiv. Beibl. 75 (1904) 56.
CLINOGYNE GRANDIS, Benth. et Hook.; Lecomte, Fl. Indo-Chine, vi. (1908) 124.
CLITORIA MARIANA, Linn.; Henry, n. 11,147, Herb. Kew.
CNICUS CHANROENICUS, Nakai in Bot. Mag. Tokyo, xxiii. (1909) 187.
  DIAMANTINUS, Nakai, *l. c.* 99.
  NAKAIANUS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 168.
  PENDULUS, Maxim.; Kom. in Act. Hort. Petrop. xxv. (1907) 749.
  RHINOCEROS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 168.
  TAQUETII, Léveillé et Vaniot, *l. c.*
  UNINERVIUS, Lévéillé et Vaniot, *l. c.* p. 169.
  WALLICHII, Hook. f.; Matsum. et Hayata in Journ. Coll. Sci. Tokyo, xxii. (1906) 211.
CNIDIUM DAURICUM, Turcz.; Kom. *l. c.* (1905) 153.
  FORMOSANUM, Yabe in Journ. Coll. Sci. Tokyo, xvi. IV. (1902) 63.
  SALINUM, Turcz.; Bullock, n. 58, Herb. Kew., sub *Selinum*.
COCCULUS LAURIFOLIUS, DC; Matsum. et Hayata in Journ. Coll. Sci. Tokyo, xxii. (1906) 14.
  LENISSIMUS, Gagn. in Bull. Soc. Bot. Fr. lv. (1908) 36.
  MOLLIS, Wall.; Diels in Engl. Pflanzenreich, Menisperm. (1910) 235.
COCHLEARIA FUMARIOIDES, Dunn in Journ. Linn. Soc., Bot. xxxviii. (1908) 355.
CODONOPSIS CARDIOPHYLLA, Diels ex Kom. in Act. Hort. Petrop. xxix. (1908) 117.
  CORDIFOLIA, Kom. *l. c.* 108.
  DELTOIDEA, Chipp in Journ. Linn. Soc., Bot. xxxviii. (1908) 387.
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PRUNUS, see also *Amygdalus* and *Padus*.

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  canescens, Bois in Vilm. et Bois, Frut. Vilm. Cat. 1904, 66.
  clarofolia, C. K. Schneider in Fedde, Repert. Nov. Sp. i. (1905) 67.
  consociiflora, C. K. Schneider, *l. c.* 54.
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  dictyoneura, Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 57.
  Fauriei, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 198.
  Fordiana, Dunn in Journ. Bot. xlv. (1907) 402.
  Giraldiana, C. K. Schneider in Fedde, Repert. Nov. Sp. i. (1905) 65.
  glandulifolia, Rupr.; Nakai in Journ. Coll. Sci. Tokyo, xxvi. i. (1909) 211.
  ichangana, C. K. Schneider in Fedde, Repert. Nov. Sp. i. (1905) 50.
  Kawakamii, Hayata in Journ. Coll. Sci. Tokyo, xxv. xix. (1908) 77.
  litigiosa, C. K. Schneider in Fedde, Repert. Nov. Sp. i. (1905) 65.
  Maackii, Rupr.; Kom. in Act. Hort. Petrop. xxii. (1904) 549.
  marginata, Dunn in Journ. Bot. xlv. (1907) 402.
  Nakai, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 198.
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  Sargentii, Rehder in Mitt. Deutsch. Dendr. Ges. 1908, 159.
  seoulensis, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 198.
  Taqueti, Léveillé et Vaniot, *l. c.* 197.
  Wilsoni, Diels ex C. K. Schneider in Fedde, Repert. Nov. Sp. i. (1905) 69.
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Pterospermum diversifolium, Blume; Henry, n. 11,354, Herb. Kew.
Pterostyrax psilophyllus, Diels in Perk. in Engl. Pflanzenreich, Styrac. (1907) 103.
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  Argyi, Léveillé et Vaniot in Bull. Soc. Bot. Fr. lv. (1908) 426.
  cærulea, Léveillé et Vaniot, *l. c.* 427.
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  Collettii, Prain; Henry, n. 13,254, Herb. Kew.
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  Thomsoni, Benth.; Ducloux, n. 746, Herb. Kew.

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PUTRANJIVA ROXBURGHII, Wall. ; Matsum. et Hayata in Journ. Coll. Sci. Tokyo, xxii. (1906) 362.
PYCNARRHENA MACROCARPA, Diels in Engl. Pflanzenreich, Menisp. (1910) 52.
PYROLA MEDIA, Sw. ; Faber, n. 943, Herb. Kew.
  MORRISONENSIS, Hayata in Journ. Coll. Sci. Tokyo, xxv. XIX. (1908) 155.
  RENIFOLIA, Maxim. ; Kom. in Act. Hort. Petrop. xxv. (1905) 192.
  SECUNDA, L. ; Kom. *l. c.* 191.
PYRUS, see also *Micromeles* and *Sorbus.*
  FAURIEI, C. K. Schneider in Fedde, Repert. Nov. Sp. iii. (1906) 120.
  HUPEHENSIS, Pamp. in Nuov. Giorn. Bot. n. s. xvii. (1910) 291.
  KOEHNEI, C. K. Schneider in Fedde, Repert. Nov. Sp. viii. (1910) 119.
  KOLUPANA, C. K. Schneider, *l. c.* 120.
  MOKPOENSIS, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 200.
  POLYCARPA, Hook. f. ; Henry, n. 11,296, Herb. Kew.
  SUBCRATÆGIFOLIA, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 199.
  TAQUETI, Léveillé, *l. c.*
  TIANSHANICA, Franch. ; Przewalski, n. 428, Herb. Kew.
  VANIOTI, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 200.
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  diffusus, DC.; Finet et Gagn., Fl. As. Or. i. (1905) 109.
  dissectus, Bieb.; Finet et Gagn. *l. c.* 111.
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  Flammula, Linn.; Finet et Gagn. in Fl. As. Or. i. (1905) xi.
  hirtellus, Royle; Finet et Gagn. *l. c.* 120.
  lanuginosus, Linn.; Finet et Gagn. *l. c.* 106.
  sardous, Crantz; Finet et Gagn. *l. c.* xi.
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  hypochrysus, C. K. Schneider, *l. c.* 76.
  iteinophyllus, C. K. Schneider, *l. c.*
  koraiensis, C. K. Schneider, *l. c.* 77.
  lamprophyllus, C. K. Schneider, *l. c.* 78.
  leptophyllus, C. K. Schneider, *l. c.* 77.
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  Brettii, Hemsl. et E. H. Wils. in Kew Bull. 1910, 106.
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  HOULSTONII, Hemsl. et E. H. Wils. *l. c.* 110.
  INSIGNE, Hemsl. et E. H. Wils. *l. c.* 113.
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  LONGESQUAMATUM, C. K. Schneider, Ill. Handb. Laubholzk. ii. (1909) 483.
  MARIESII, Hemsl. et E. H. Wils. in Kew Bull. 1907, 244.
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  POUKHANENSE, Léveillé in Fedde, Repert. Nov. Sp. v. (1908) 100.
  PRIMULINUM, Hemsl. in Gard. Chron. 1910, i. 4.
  PSEUDOCHRYSANTHUM, Hayata in Journ. Coll. Sci. Tokyo, XXV. XIX. (1908) 154.
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  RIREI, Hemsl. et E. H. Wils. in Kew Bull. 1910, 111.
  SHELTONÆ, Hemsl. et E. H. Wils. *l. c.* 108.
  SPOONERI, Hemsl. et E. H. Wils. *l. c.* 110.
  TUTCHERÆ, Hemsl. et E. H. Wils. *l. c.* 116.
  VILLOSUM, Hemsl. et E. H. Wils. *l. c.* 119.
  WASONII, Hemsl. et E. H. Wils. *l. c.* 105.
  WATSONI, Hemsl. et E. H. Wils. *l. c.* 112.
  WILSONÆ, Hemsl. et E. H. Wils. *l. c.* 116.
  WILTONII, Hemsl. et E. H. Wils. *l. c.* 107.
  WONGII, Hemsl. et E. H. Wils. *l. c.* 117.
RHODOTHAMNUS CHAMÆCISTUS, Reichb. ; James, 1886, Herb. Kew.
RHUS INSIGNIS, Hook. f. ; Henry, n. 11,907, Herb. Kew.
  INTERMEDIA, Hayata in Journ. Coll. Sci. Tokyo, XXV. XIX. (1908) 73.
  PANICULATA, Wall. ; Henry, n. 11,578 A, Herb. Kew.
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  WILSONI, Hemsl. in Kew Bull. 1906, 155.
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manshuricum, Kom. in Act. Hort. Petrop. xxii. (1904) 437.
Maximoviczii, Kom. *l. c.* 443.
orientale, Desf.; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 81.
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Vilmorini, Jancz. *l. c.*
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sinensis, Léveillé, *l. c.*
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multibracteata, Hemsl. et E. H. Wils. *l. c.* 157.
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Sinowilsoni, Hemsl. *l. c.*

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præcox, K. Schumann, *l. c.* 122.
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amabilis, Focke in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 53.
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ampliflorus, Léveillé et Vaniot in Bull. Soc. Bot. Fr. li. (1904) 218.
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assamensis, Focke; Focke in Bibl. Bot. xvii. (1909) 53.
Blinii, Léveillé in Fedde, Repert. Nov. Sp. vii. (1909) 258.
Bonatii, Léveillé, *l. c.* 338.
calycanthus, Léveillé in Fedde, Repert. Nov. Sp. viii. (1910) 58.
calycinus, Wall.; Henry, n. 10,641, Herb. Kew.
Cavaleriei, Léveillé et Vaniot in Bull. Soc. Bot. Fr. li. (1904) 218
clemens, Focke in Bibl. Bot. xvii. (1909) 105.
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diamantina, Léveillé in Fedde, Repert. Nov. Sp. v. (1908) 279.
Dielsianus, Focke in Bibl. Bot. xvii. (1909) 53.
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melanolasius, Focke; Kom. in Act. Hort. Petrop. xxii. (1904) 484.

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paykouangensis, Léveillé, *l. c.* 333.

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Pyi, Léveillé in Fedde, Repert. Nov. Sp. vi. (1908) 111.

quelpaertensis, Léveillé, *l. c.* v. (1908) 280.

refractus, Léveillé, *l. c.* iv. (1907) 332.

rufus, Focke in Bibl. Bot. xvii. (1909) 108.

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singulifolius, Focke in Bibl. Bot. xvii. (1909) 77.

sitiens, Focke, *l. c.* 117; *R. tibetanus*, Focke, *l. c.* 29.

stephanandra, Léveillé in Fedde, Repert. Nov. Sp. viii. (1910) 358.

talaikiaensis, Léveillé in Fedde, Repert. Nov. Sp. iv. (1907) 334.

Taqueti, Léveillé, *l. c.* vii. (1909) 340.

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viscidus, Focke in Bibl. Bot. xvii. (1909) 108.
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  - Fauriei, Léveillé et Vaniot, *l. c.* 401.
  - glechomifolia, Léveillé et Vaniot, *l. c.*
  - Komarovii, Léveillé et Vaniot, *l. c.* 402.
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  - kuisianum, Makino; Nakai in Journ. Coll. Sci. Tokyo, xxvi. i. (1909) 231.
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  - Liciæ, Hamet, *l. c.* lvi. (1909) 569.
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  - Yvesi, Hamet, *l. c.* 27.
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  - japonicum, Miq. ; Nakai, *l. c.* 263.
  - papyraceum, C. B. Clarke ; Henry, n. 692, Herb. Kew.
  - tenuifolium, Wall. ; Henry, n. 9816, Herb. Kew.
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  - alatus, Wall. ; Henry, n. 11,159, Herb. Kew.
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  - Buimalia, Buch.-Ham. ; Henry, n. 9274, Herb. Kew.
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  NAGENSIUM, C. B. Clarke ; Wilson, n. 3805, Herb. Kew.
  NUDIBASIS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. vi. (1909) 331.
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  SPLENDENS, Léveillé et Vaniot in Fedde, Repert. Nov. Sp. viii. (1910) 139.
  TAQUETII, Léveillé et Vaniot, *l. c.*
  TRILIGULATUS, Buch.-Ham. ; Henry, n. 12,779, Herb. Kew.
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  HIRSUTA, Baker ; Henry, n. 12,480, Herb. Kew.
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Lyi, Léveillé in Fedde, Repert. Nov. Sp. viii. (1910) 171.
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ocreata, Léveillé et Vaniot, *l. c.* 354.
pinfaensis, Léveillé et Vaniot, *l. c.* 355.
stemonifolia, Léveillé et Vaniot, *l. c.* 356.
tortopetiolata, Léveillé et Vaniot, *l. c.* 354.
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  - tapashana, C. K. Schneider, *l. c.* 313.
  - Vilmorini, C. K. Schneider, *l. c.* 317.
  - Wilsoniana, C. K. Schneider, *l. c.* 312.
  - Zahlbruckneri, C. K. Schneider, *l. c.* 318.
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  - simplex, Huds. ; Kom. in Act. Hort. Petrop. xx. (1901) 218.
  - stenophyllum, Maxim. ; Kom. *l. c.* 219.
  - stoloniferum, Buch.-Ham. ; Diels in Engl. Jahrb. xxxvi. Beibl. 82 (1905) 4.
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  - hirsuta, C. K. Schneider, *l. c.* 342.
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  - Maximowicziana, C. K. Schneider in Bull. Herb. Boiss. sér. 2, v. (1905) 341.
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rotunda, Lour.; Farges, n. 349, Herb. Kew.

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scandens, Hemsl. *l. c.*

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auriculatus, Nees; Henry, n. 12,570 a, Herb. Kew.

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  ERNESTI, Dunn (nom. nov.) ; *S. Wilsoni*, Brand, *l. c.* 216, *non* Hemsl.
  GLOMERATA, King ; Henry, n. 13,525, Herb. Kew.
  HOOKERI, C. B. Clarke ; Henry, n. 12,412, Herb. Kew.
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strumarium, Gagnep. *l. c.* 267.

yunnanense, Gagnep. *l. c.* 270.

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